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OUT OF THIS WORLD!

EDHEAD

If you build it...

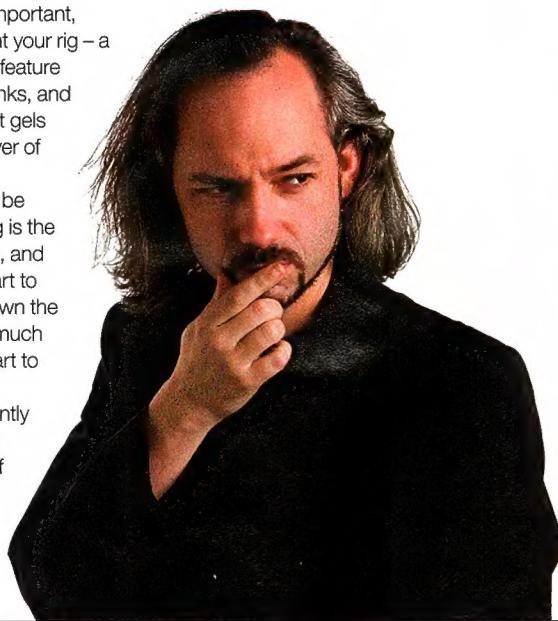
It's back to basics, this issue, and there's nothing more basic than building a kick arse PC. It's a talent that'll serve you and those you know very well.

Whether you're a hardcore gamer, a tech enthusiast, or just like the feeling of having a PC full of the latest gear, knowing exactly what's in your machine and how it all goes together is like a rally driver knowing how to fix and maintain their car – it's an essential skill by any measure.

The ability to hand-pick every component is also vital, allowing you to build a system to your ideal spec of budget and performance – not someone else's! If you're building a machine to power the next big game release, you can make sure that you meet its recommended specs. Picking the parts also lets you look at things from an aesthetic angle, too. If you're going to have a windowed case, making sure that all your parts look good can be very important, especially if you're going to light your rig – a lot of components these days feature coloured PCBs, groovy heatsinks, and cool logos, so getting gear that gels together adds a whole new layer of class to your rig.

And then, of course, it can't be denied that building something is the best way to learn how it works, and that can really help if things start to go wrong with your system down the track. Having built it, you'll be much more comfortable taking it apart to find the offending culprit.

And, perhaps most importantly for some... there's the fact that building a system – for yourself or a friend/family member – can knock thousands of dollars off the cost. You're not paying someone else



atomicCREW

editorial
editorial@atomicmpc.com.au
editor david hollingworth
deputy editor justin robinson

design
art director david west
product photography
jason busch
creative director sam grimmer

contributors
dan rutter, ashton mills, chris taylor,
jake carrol, seamus byrne, ben mansill

production
group production manager angela sutherland
production manager ewa grygier
printed by webstar

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(02) 9282 8777
gordon & gothch new zealand
(09) 625 3005

advertising + marketing
t+61 2 8399 3611 f+61 2 8399 3622
group advertising manager joanne nichols
jnichols@haymarketmedia.com.au

haymarket media
t+61 2 8399 3611 f+61 2 8399 3622
52 victoria street, mcmahons point
nsw 2060

managing director jeremy vaughan
commercial director darren mcnally
publishing manager phil vella

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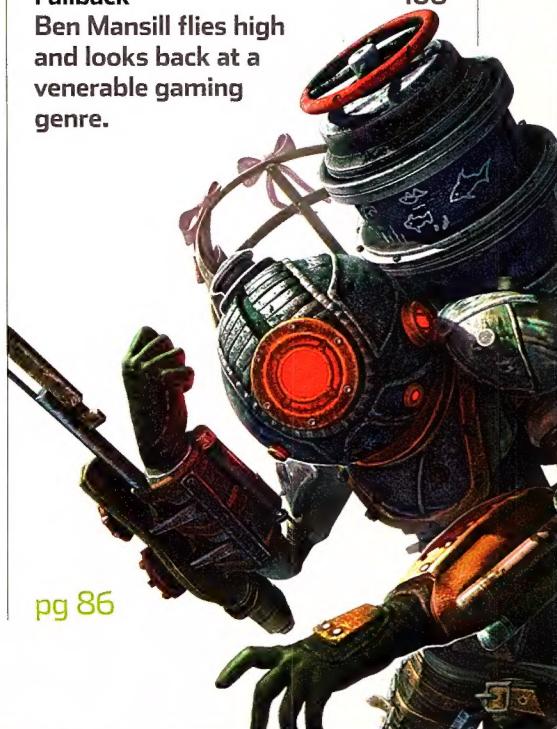
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Ben Mansill flies high and looks back at a venerable gaming genre.



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SLI



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New!
nVidia GTX 280M
Graphics



FIRST
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nVidia
9600+9100

New
HYBRID SLI
Graphics



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Intel Light Peak optical interconnect is blisteringly fast

Speeds up to 10Gbps over huge distances.



Though you'd never guess from the oddly named Light Peak announcement, it's not an information-deprived sneaky look at something but rather a brand-new optical technology that aims to provide a huge amount of bandwidth.

It uses a special controller much the same as the USB standard, and even the connector looks quite similar, but the performance hits 10Gbps sustained over a 100m distance.

Most interesting of all is that it's a standard for mobile devices more than anything, giving ultrafast bandwidth to perform all the tasks future devices might want to support - from external displays, media streaming and ultrafast data syncing.

It'll be good to have a standard fast connector to use, but sadly Light Peak is sometime off in the distance, running only in prototype stages for now and not being anywhere near small enough to fit inside a mobile device.

Sony's PS3 and the yellow light of death

Is this another RROD-esque nightmare, or a simple annoyance?

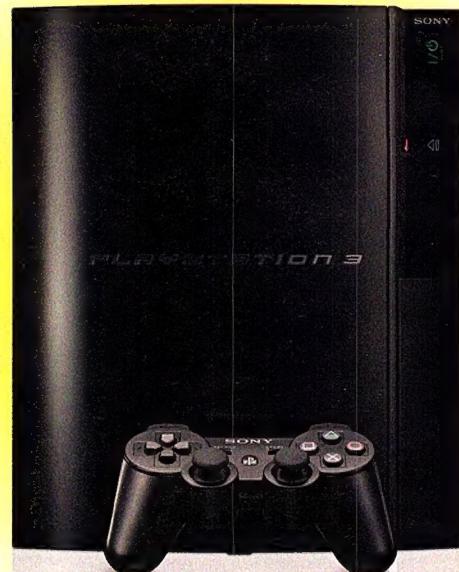
The launch of the Xbox 360 was an exciting one - but became much less so when a phenomenal amount of consoles succumbed to the dreaded Red Rings of Death, lovingly called RROD. Sony countered this with claims that their console was incredibly reliable, but recent news might give console gamers something to think about.

Caused by a similar fault to the 360, the PS3 develops a blinking yellow light on the front of the console and refuses to boot, mostly affecting 60GB launch consoles purchased about two years ago. The problem stems from weak soldering, and when the console is disassembled then heated in a reheater

to melt the existing solder, many of the consoles are functional again.

This could easily be manufacturing niggles from the first wave of consoles before the process was smoothed out, but the major difference here is that unlike Microsoft's free repair for RROD (itself brought around by the huge amount of failed consoles), you'll have to pay Sony to repair the console unless it's less than a year old.

The good news is that it has only affected 0.5 per cent of consoles so far, meaning that odds are you're not going to be too worried about your console failing. Keep it somewhere with plenty of ventilation, and cross your fingers it doesn't die.



Okay, it's that lovely part of the magazine where we celebrate the best the forums have to offer. And this month, we celebrate none other than...

Stadl! Who struts his circuitry knowledge along with several bright ideas.
<http://forums.atomicmpc.com.au/index.php?showtopic=21484&view=findpost&p=429487>

And we have a mess of runners up. This one has no one winner, but it's an great piece of Atomic mindshare and tech support.
<http://forums.atomicmpc.com.au/index.php?showtopic=21377>

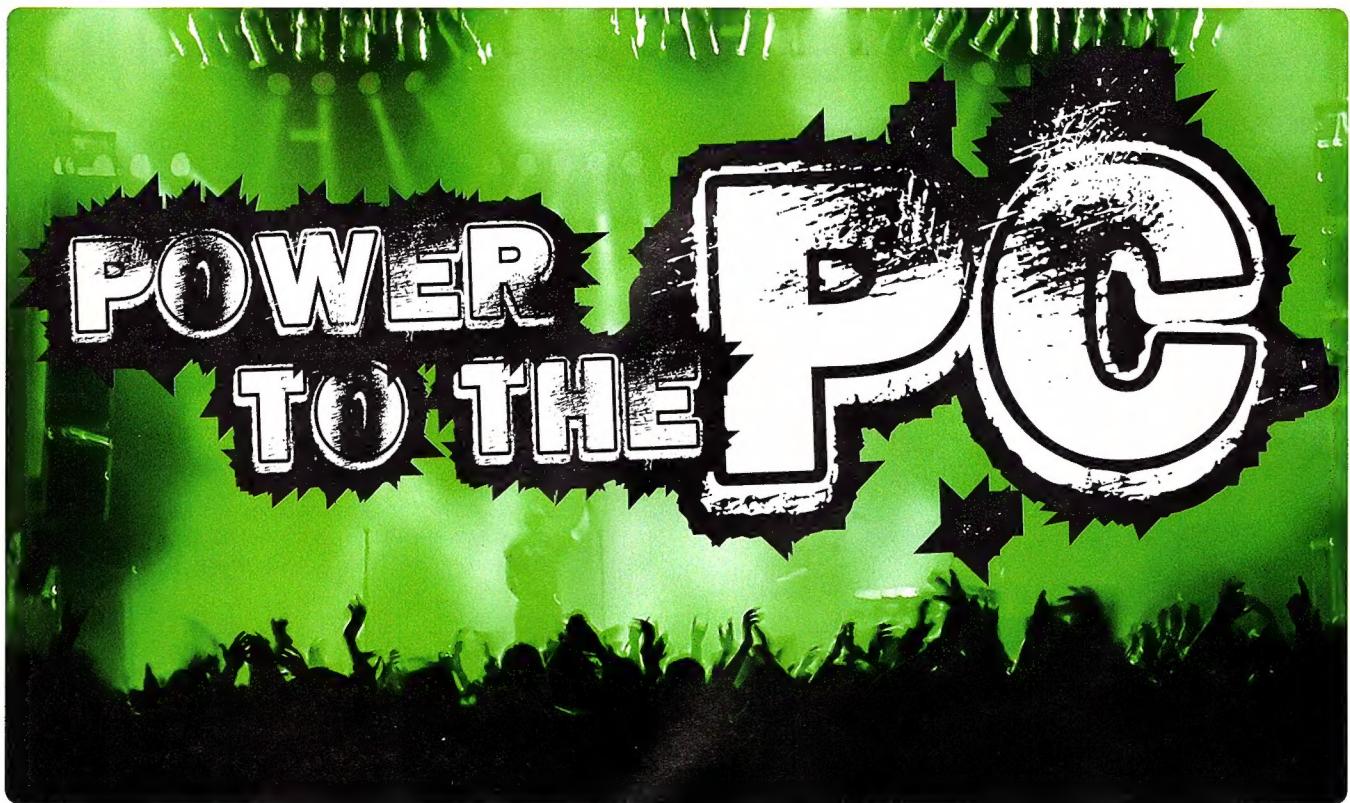
NagChampa offers a thread with neat insight into web security and programming.
<http://forums.atomicmpc.com.au/index.php?showtopic=21021&st=0&#entry419051>

micheal.jenkins continues to post solid gold win with another a piece of getting ahead.
<http://forums.atomicmpc.com.au/index.php?showtopic=21423&st=0&p=427754>

Monis asks us who we are, and gets an awesome ball rolling about the community, and Atomic.
<http://forums.atomicmpc.com.au/index.php?showtopic=21401&st=0&p=427042&#entry427042>



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Sydney Tour!

Atomic, cutting-edge tech, incredibly exclusive game access and plenty more!

The first Power to the PC Tour happened last night in Sydney, bringing together more Atomicans than could ever have fit in a single LAN event and more tech than you could poke with a metaphorical stick - and we've taken so many photos you'd almost swear you were at the University of Technology Sydney (UTS) with us.

First and most importantly is a huge thanks to our sponsors across all the different components that made the night incredible fun for all involved, as well as the speakers who gave presentations and answered questions with enthusiasm.

MSI brought along its latest P55-based motherboards and a whole host of graphics cards to boot, and while the 5870 hadn't been officially released (it should be around on the internet around the time you read this!), MSI also had its latest heatsinks and cooling solutions available on display. The Product Manager for Components, Jerry Lee, gave his talk about the tech powering MSI's gear, with plenty of info you can't get anywhere else.

Intel brought Technology Manager Graham Tucker to the Tour, guiding us through the latest in Intel CPUs as well as showing off just how tiny an Atom chip is - comparable in size to a grain of rice! He also brought along a 300mm wafer filled with Nehalem dies, worth an



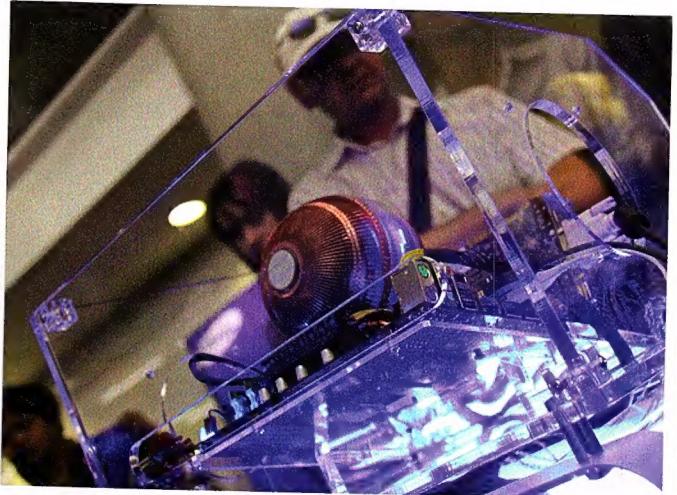


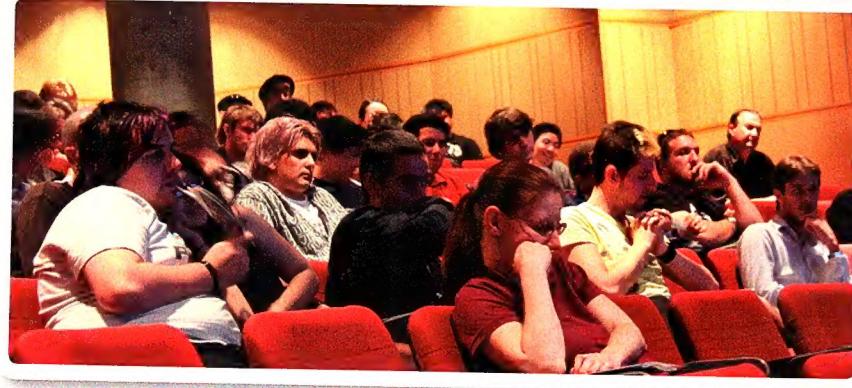
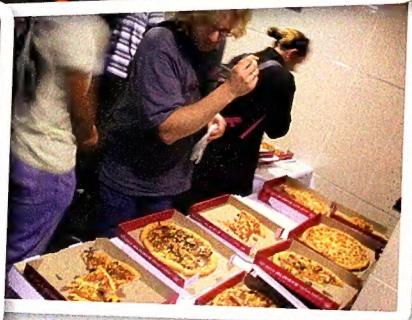
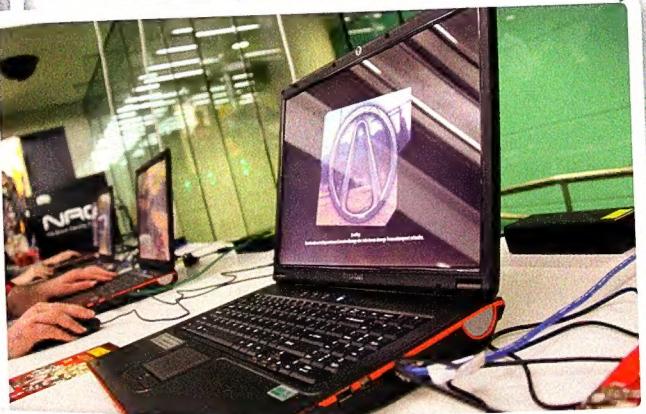
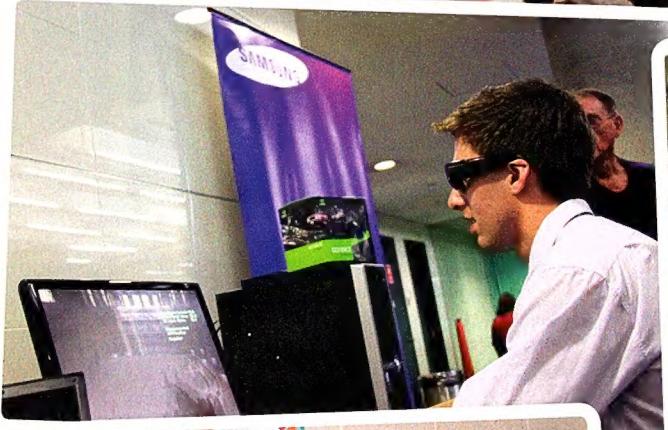
effective \$US60,000 if it were ever sliced up for actual chips!

Samsung was represented by Emmanuele Silanesu, the National Product & Marketing Manager for the IT division. He showed off the latest LCD screens - the first available in Australia that run at the 120Hz needed to partner with NVIDIA's 3D Vision goggles. Gamers had a blast with Call of Duty 4 in 3D, the very first showing of this 3D tech in Australia.

Kingston showed off its highest end memory kits, and we got a walkthrough from Marites Bairstow through both Kingston's history as well as its products. There's some exciting things happening in the SSD space, something that Kingston is keeping its eyes on - so watch that space closely.

2K Games gave us exclusive worldwide access to Borderlands on PC - the actual release date for the game is





20/10/09, but we nabbed code so fresh that even reviewers all over the world haven't got their hands on it yet. Atomicans were the first people to play the game outside 2K offices, and many commented on the great look of the cartoony graphics.

Speaking of which, Borderlands was also run on four Pioneer gaming laptops to show how the game can be run even on the go. Powered by a 2.16GHz Core 2 Duo and a 9800GTX Mobile, these lappies had gorgeous widescreen LCDs at a huge resolution of 1920x1200 - basically a 24in desktop screen res. Even better, they ran the game on the highest settings, a remarkable feat for any laptop 

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A world of
Touch



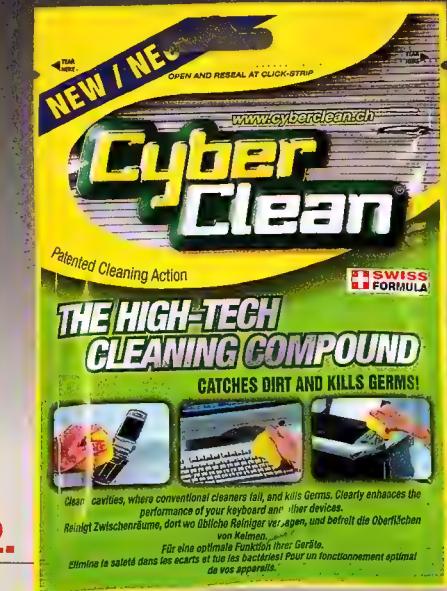
When it comes to individuality, the Samsung GALAXY icon offers endless possibilities for customisation. It's been designed with the internet in mind and in particular, a Google™ experience like no other. The Android™ platform means you can personalise your entire phone with a multitude of Google apps and have access to high speed internet and Wi-Fi connectivity.

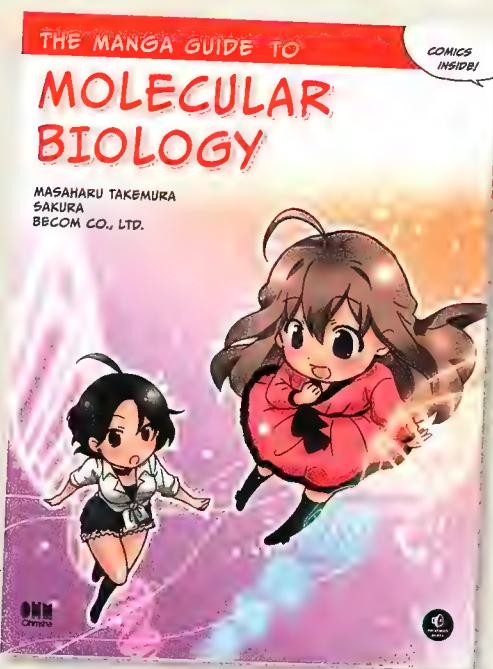


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1. Canon EOS 7D

Price TBC Website www.canon.com.au/worldofeos

We like a bit of photography here at Atomic. Whether it's getting gorgeous shots of hot new tech, grabbing candid snaps of our friends or even dabbling in the odd bit of miniature photography (<http://www.flickr.com/photos/hawks-eye/3821999116/>), we're very partial.

And boy do we like the new EOS 7D from Canon. The 7D features a GIGANTIC 18MP CMOS, dual image processors. It can also record in full HD, so whether your subject is still or on the move, you'll capture it in glorious detail.

2. Cyber Clean

Price \$6.95 and up Website www.cyberclean.ch

Do you remember silly putty, and all those other slimy 'toys' that would slither down walls, make good fake snot, and generally disgust other people but be kind of fun to play with? Do you remember the way it sucked in dust and gunk?

Well, we do, and so do the guys behind Cyber Clean, and neat re-purposing of comedy goo to keep tech clean.

It's hardly a sleek or glamourous product, but it is hella useful. It can dig all kinds of gunk out of keyboards, and being non-water-based, is perfect for picking crap out of fans, off of motherboards and expansion cards, and other generally hard to get to and sensitive places.

And... yeah. You can still use it to gross people out. Dual purpose gear for the win!

3. Sony Super MUTEKI

Price \$2199 Website www.sony.com.au

Sweet Zombie Jesus!

Look at those speakers – go on, forget the text, just look at all those speakers. We'll give you a moment.

That's Sony's massive MUTEKI sound system, a whopping 7.4 channels of HD sound, requiring the two included amps to pump up out some ear-bleedingly powerful noise – 2095W worth! With three HDMI inputs, component video and Sony's Digital Cinema Auto Calibration, this is pretty much the last word in the over the top home entertainment.

And we want one.

As well as a house capable of withstanding the vibration of repeatedly playing the opening sequence from Star Wars.

4. Bose Mobile In-Ear Headset

Price \$199 Website www.bose.com.au

We admit – we're a sucker for Bose speakers. The crisp sound reproduction, the excellent design, the cache of cool of the name itself. We fall for it every time, and these new in-ear models have us just as intrigued.

The Bose Mobile In-Ear phones are designed for use with all modern phones, in particular the media power house and fellow icon of cool, the iPhone. The phones feature Bose TriPort acoustic structure, sound electro acoustic design and have been designed to sit in the ear for extended periods of time. To make them even more comfy, there's a selection of differently-sized silicone ear plugs.

Neato.

5. The Manga Guide to Molecular Biology

Price \$37.95 Website www.woodslane.com.au

If you – like us – believe that there's nothing that a Japanese schoolgirl cannot do, this book will be just one more proof of that theorem.

The Manga Guide to Molecular Biology is a "gentle and fun cartoon guide to this vast topic."

In this book you'll follow our heroines Ami and Rin as they catch up on a whole missed semester of schoolwork using virtual reality and miniskirts, and meeting such characters as Enzyme Man and Drinkzilla.

I wonder if there's tentacles...

Head in the clouds



Jake Carroll has his head in the Cloud, this month, and what he sees is pretty serious tech.

Love them or hate them, social networking technologies are here to stay. Platforms such as FaceBook, MySpace and the seemingly ubiquitous Twitter are possibly the most important behaviour-changing mechanisms the internet has seen in the last decade. Sure, it doesn't matter that your mate next door just twittered to tell the internet that he's finally succeeded in beating Zork while on a cookie dough binge, when he could have just walked across the pavement to tell you. What matters are the possibilities. This month, Atomic takes you into the cloud, to understand the technologies that power these fun, chatty and mighty obsessive services of massive scale.

Cumulowhatus?

'Cloud Computing' is a term that encapsulates a geographically and proportionally different mode of using computing resources to what people are generally accustomed to. Geographically different, because cloud computing resources are generally distributed a long way from where a user might actually be using said resource, and because the resource might exist in many places at any given time. Proportionally different, because the available capacity of the resource is many times that of a traditional multi user system.

• Compute clouds

- High Performance Computing.
- Rendering.
- Biological analysis.
- Petrochemical engineering.
- Simulation.

- Storage Clouds
 - High capacity, high latency bulk storage mechanisms.
- Application clouds
 - Web services.
 - Web 2.0 style applications.
 - Media and content services.

Another way cloud technologies can be classified are as different service-fulfillers:

- Infrastructure as a service (IaaS).
- Platform as a service (PaaS).
- Software as a service (SaaS).



TACC Ranger, Texas, USA, a part of TeraGrid. The largest supercomputing grid in the world, and effectively one of the largest compute clouds in existence, is free-to-use for all US researchers, with good justification!

How a cloud operates

So we now have the fundamentals of what exists, but how do these invisible monsters operate? Cloud technologies assume a couple of things:

Assumption 1:

At some point, there is the likely event of a loss of hardware, software, or the communications links to the hardware and software platforms that go into the mix to create the cloud.

Assumption 2:

The performance requirements can expand as wide as needed to meet demand for a service hosted in a cloud.

The way in which these assumptions are met with answers depends on what kind of cloud service is being provided (be it compute, storage or application).

Looking after compute availability in the cloud

Compute availability stems from the ability of a service to have resilience in a 'fail one or ten nodes and continue' environment. The best examples of mass compute power are found in supercomputing grid environments. The most common tools used in large grids are custom 'grid' operating systems such as Linux ROCKS, oftentimes utilising tools such as Sun Grid Engine as a means to schedule jobs to 'nodes' or individual systems, all acting as one to achieve a large computationally complex outcome. The magic comes in when a node fails,

FIGURE 1

queueusername	qtype	resv/used/tot.	load_avg	arch	states
all.q@atomicgrid-01.atomicmpc.com.au.	BIP	0/0/1		-NA-	darwin-x86
all.q@atomicgrid-02.atomicmpc.com.au.	BIP	0/0/0	0.00	darwin-x86	
all.q@atomicgrid-03.atomicmpc.com.au.	BIP	0/0/4	0.03	darwin-x86	s
all.q@atomicgrid-04.atomicmpc.com.au.	BIP	0/0/4	0.01	darwin-x86	s
all.q@atomicgrid-05.atomicmpc.com.au.	BIP	0/0/4	0.00	darwin-x86	s
all.q@atomicgrid-06.atomicmpc.com.au.	BIP	0/3/4	0.08	darwin-x86	a
474287 0.55002	run_supercrunch	SR	09/16/2009 16:09:23	1	210
474287 0.55002	run_supercrunch	SR	09/16/2009 16:12:23	1	362
474287 0.55002	run_supercrunch	SR	09/16/2009 16:06:53	1	383

or communication fails. The actual utilisation of backend resources, networking, CPU time allocation and scheduling are in the cloud, or black box – an interchangeable term here. Such an example of an extremely powerful compute cloud is the TeraGrid initiative, or even Amazon's Elastic Compute 2 (EC2).

The ability of a compute cloud to self heal is dependent upon networking infrastructure and communications channels between compute nodes, but also the grid engine used. An example of some SGE output is shown in Figure 1. Here, we see a group of tasks known as 'run_supercrunch' spreading workload across six nodes (atomicgrid-01 thru 06). If a node fails, or has a lack of availability, sge_QUEuemaster daemons simply reschedule that 'chunk' to a

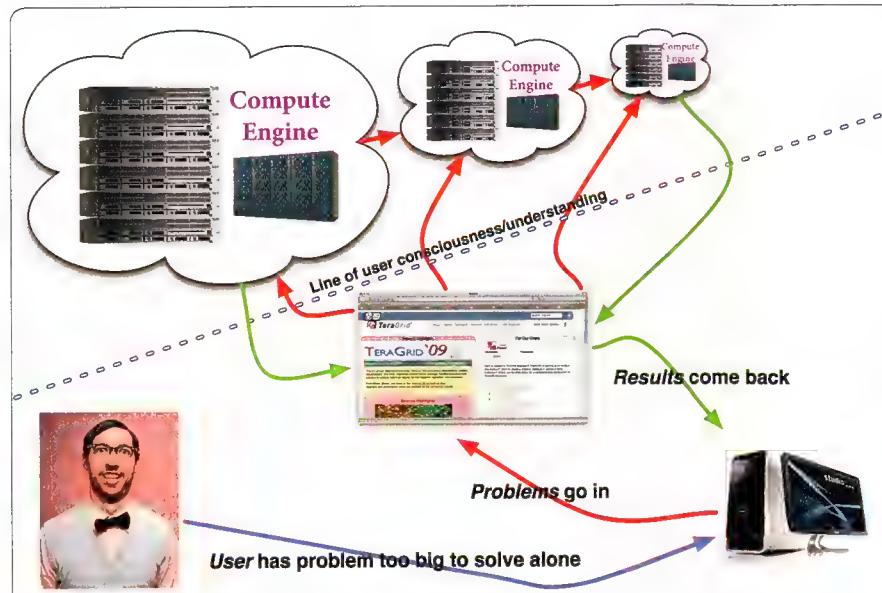
the job to another node and the user is none the wiser. Likewise, if more compute power is needed, the daemon will simply detect this based upon idle CPU time percentage on any given node, and schedule the next 'chunk' to a new node.

Looking after storage availability in the cloud

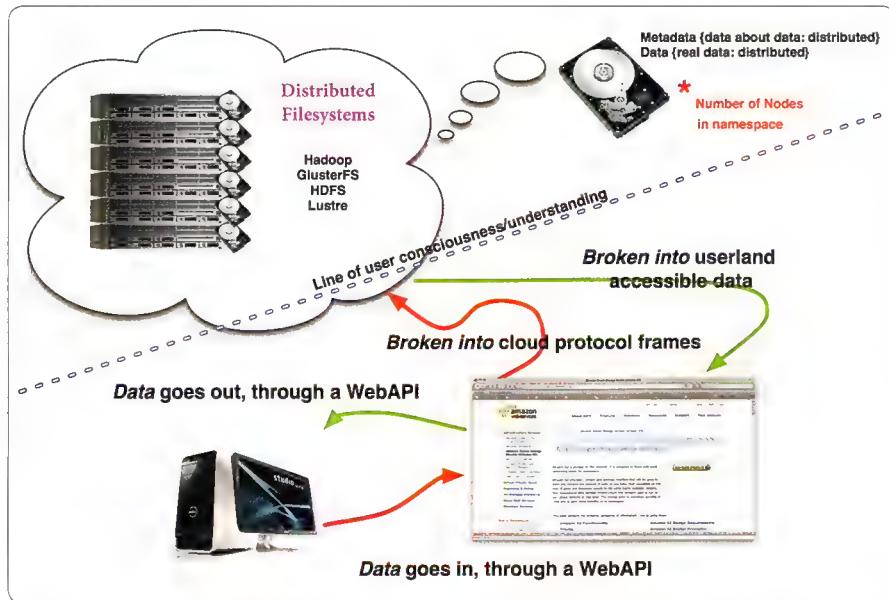
The first cloud assumption is achieved through horizontal high availability of the services, storage and system resources hosted on any given node. Data and metadata (data about data) can be in one or many locations, as set by policy.

Google's BigTable is important in understanding storage in a cloud-centric filesystem, in that it doesn't behave in the way we'd expect a traditional filesystem such as NTFS or HFS+ (or even EXT3/4/XFS) to do so. Cloud filesystems behave much like relational databases (without having a full relational model), in as much as they have global namespace aware numbers, rows, records and metadata. They are not bound to one machine, nor do they have a reliance upon one controlling node. The power of BigTable and technologies like it is the intrinsic knowledge of clients (a Google earth server, for example) to reason or rationalise the locality of the data to that particular server, thus providing low latency and availability when it counts. GFS and BigTable aren't always the answers to global namespace distributed filesystems, however, with defined issues of redundancy, scalability and interconnectivity being an issue. Other technologies that support Remote Direct Memory Access (RDMA) over low latency interconnects, such as Infiniband (40Gbps), are becoming more popular. GLusterFS is a newer generation RDMA-supporting filesystem gaining in popularity.

Companies such as Backblaze are exploiting (very) cheap storage with low cost SATA disks and Silicon Image controllers in order to provide online backup without the premiums of enterprise class infrastructure. <http://blog.backblaze.com/>



Compute clouds, such as the TeraGrid, or Amazon's EC2, effectively offer an abstracted service, where a user can submit something at a high level and have the 'black box' do the work in the background, without user intervention or even understanding. In this example, a scientist has a problem he can't solve easily with the computing power he has, so he utilises a web submission tool to a giant compute cloud. Sun Grid Engine takes care of the rest and gives him his answers back in due course. SGE abstracts the processes of sharing memory, CPU cycles and storage so that we, the users, don't need to worry about this. It also has the ability to self heal, in as much as if one node fails, or a whole cloud segment fails, another cloud segment is ready to keep working and to take its place. This is the nature of cloud compute availability.



Cloud storage isn't like SAN storage. It's all about locality and replication en masse. Gone are the days of expensive disks; being replaced with commodity hardware, cheap SATA disks and 'a machine per disk' style infrastructure. The distribution of metadata and real data across every node component and every disk in the cloud is important. As a result, the concept of RAID is slowly fading, as redundancy exists at the node and interconnects, rather than primitive block replication across disks.

Storage in the cloud has become less about the IOPS, and more about the latency, locality and replication capability with low overheads. Not to be confused with technologies from enterprise storage vendors such as Hitachi, IBM or Sun, this is just about bulk, and the effective management of it.

Looking after application availability in the cloud

Now we have the backbone of the cloud worked out, we've got compute infrastructure and

storage subsystems. On top of all of this lives the application layer, or the software services, that make a cloud a valuable proposition, so that people can interact with it meaningfully.

Current big names in this game are Google, Joyent, Amazon and Microsoft. One of the most useful gifts that Google Labs has given us over the years is MapReduce, a concept that has become almost ubiquitous to cloud computing at the application transactional layer. MapReduce is a set of libraries and frameworks that allow large distributed data sets, complex computational tasks and commonly difficult online transaction processing (OLTP) queries to be taken care of with efficiency across potentially

thousands of hosts.

In taking care of the first cloud assumption, we watch tools such as MapReduce use two steps in dealing with service integrity back to the end user.

1. Map the data set. A master node takes control of data to be processed, worked on or fed to an end user. In a similar way to SGE's queue master daemons, the work is fanned out to worker nodes if the task is significant. If nodes are unavailable or are of latency requirements beyond a certain threshold, it will send them elsewhere. The worker nodes send back the information to the master node when done.
2. The master node then collects all of the little snippets of work from the worker nodes and reassembles it to answer the original request (this could be as trivial as a Google earth lookup for a place that nobody has zoomed to XYZ magnification on before).

The intelligence in efficiency here is all about parallelism of processing beyond what a normal set of systems could achieve. It is cluster computing with a client-facing spin on things, effectively.

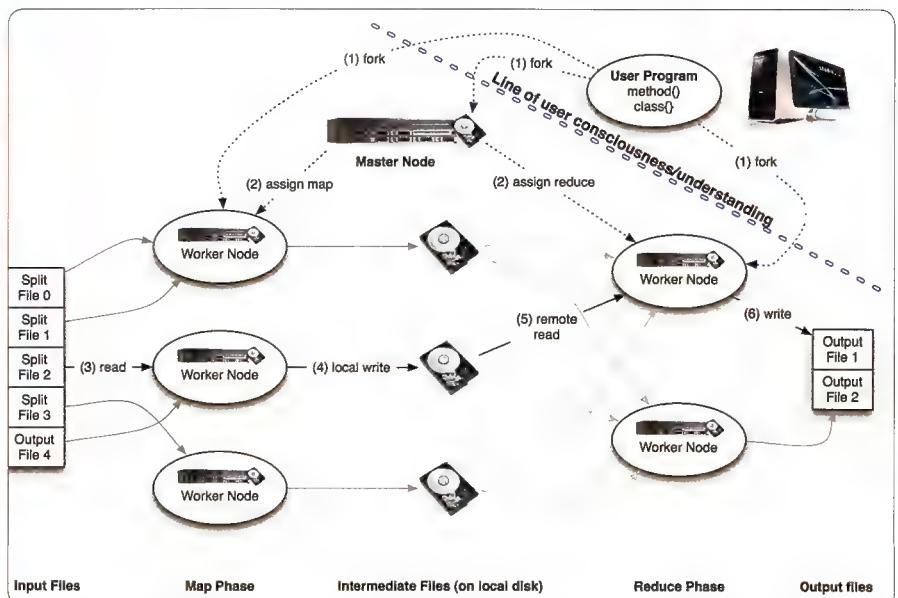
The second cloud assumption is dealt with as an effect of parallelism. In the case of MapReduce, it can run on many systems simultaneously, with the master node 'fencing' or stopping service from a given node if a health check fails. MapReduce has the ability to scale sideways when need be, or when internally configured tolerances are reached.

Things go a step further in terms of getting large amounts of content to end users over the internet quickly. All things Google aside, there are bigger net-demons sitting next to you.

Engineering millions of page views and loads per minute, let alone content serving, is no simple task – but the FaceBook team don't use esoteric technology in achieving exactly that. They use commodity server platforms



Backblaze storage modules. Just big arrays of cheap SATA, all glued together with a Linux filesystem (JFS) and some proprietary intelligence to distribute load, metadata and locality of blocks. Devoid of Infiniband to keep costs down, gigabit Ethernet rules the roost here as a means to transfer blocks from place to place.



MapReduce generic process flow. The real power of MapReduce is to take away the complexities of parallel programming and allow the API to do the hard work of message passing to cloud nodes.



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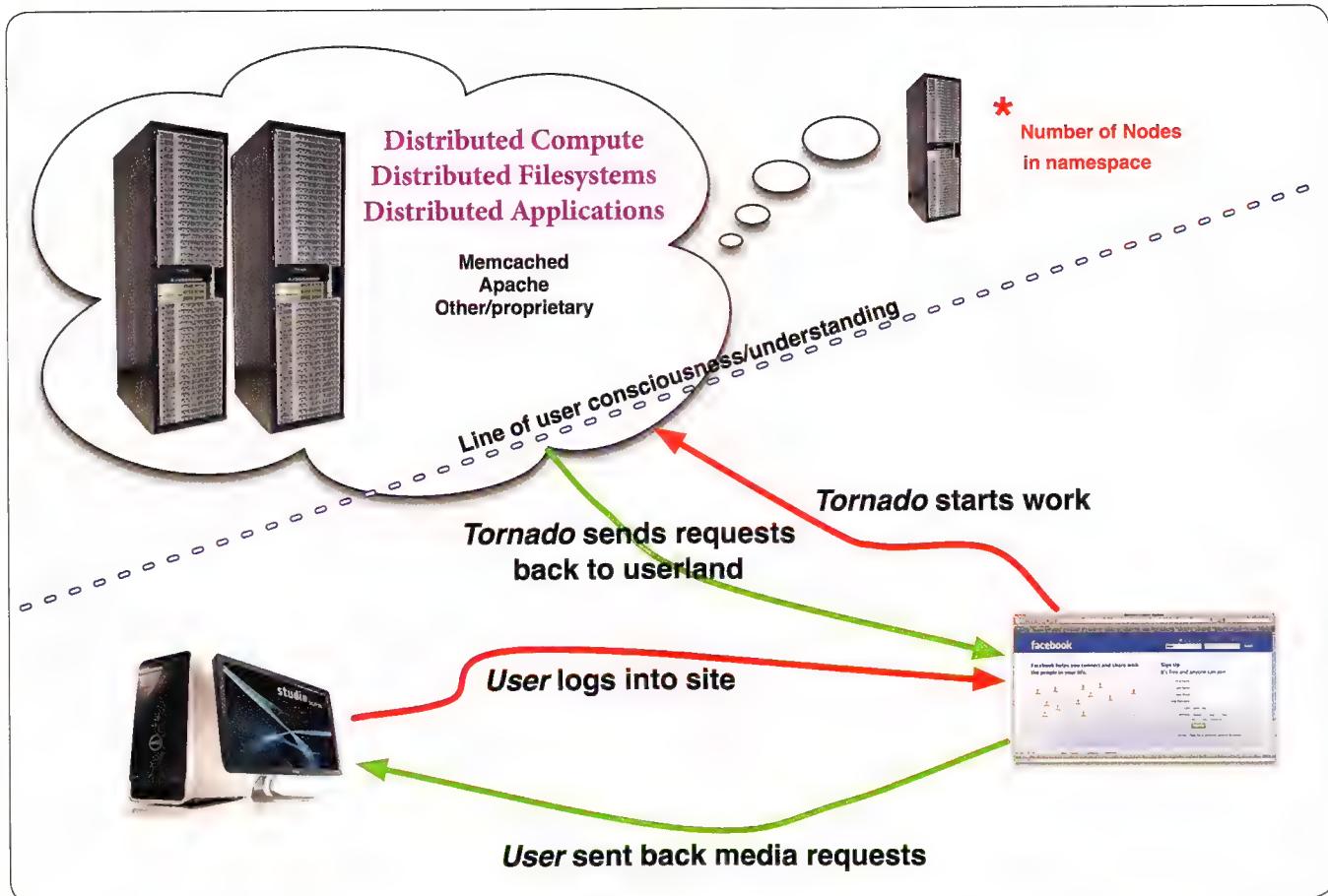
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Bringing it all together. Here, we see the use of a full set of cloud based technologies, being compute, filesystem and application. Social networking sites are a good example of just how expectant and demanding users have become. From the end user perspective, the uploading of images, movies, audio and other content has become a part of everyday internet lifestyle, all the while, hardware and software platform vendors struggle to keep abreast of such growth.

and storage subsystems, such as those we've discussed, coupled with an age-old friend of the high availability performance oriented web engineer: Memcached.

The biggest pain FaceBook has to deal with is database load and keeping client latency low per page load. To alleviate this load, memcached is implemented across approximately 900 hosts. This effectively places the onus on massively parallelised DRAM rather than a hard disk-bound filesystem, which is comparatively extremely slow in latency of seek times and IOPS. Considering an average high performance web-frontend might have 32GB of RAM these days, it's easy to scale to more than 28TB of RAM (assuming 900 nodes) in the cloud for page serving/loading/content streaming.

Companies such as Rackable/SGI have noted the growth and patterns in large 'web 2.0' style company's infrastructure habits and have attempted to cater to such demands with ultra high density (DRAM and hard disk), low cost, low power draw systems, such as the SGI Cloudrack C2.

We've tried to put the whole picture together for you here, from the low-level compute and message passing interfaces, then upwards to the storage subsystems of significant complexity, and finally gluing it all

together with application layer tools that the end user interacts with. As you might have felt from this month's X-Ray, cloud technology is hard to categorise, more appropriately being a tightly knit set of technologies already in existence coming together to supply larger demands than the 'old internet' could ever take care of. The implications of the cloud itself

are complex, and we are only just beginning to understand them. Issues of privacy, data integrity, compliance and data transportability between different cloud services and APIs have all started to appear on the horizon. It's new and fresh. How all this will be dealt with is still up in the air, much like the technology itself.

The implications of the cloud itself are complex, and we are only just beginning to understand them.



INPUTOUTPUT

Dan Rutter brings the answers to your questions like no-one else can.

I/O OF THE MONTH

Try 320 x 240 and someone else's glasses

I I've got a year-old media rig equipped with a 2.something-GHz Intel Core 2 Duo CPU, that's been working flawlessly for all my media needs since I bought it. Now, however, I'm contemplating getting a bigger monitor. I've got an old 19in 1280 x 1024 LCD, and I'm thinking about getting a 32in HDTV to use as a screen.

My worry is that the CPU won't be able to deliver enough pixels (1920 x 1080 or 1920 x 1200) in real-time. My question is simply whether a faster graphics card would help. I'm now using the built-in GMA X3500 video of my Intel G35-chipset motherboard, that claims to support '1080p HD video' if using Vista. Due to Hollywood lobbying they won't let me use some of the driver acceleration in XP, though.

I'm mainly using VLC for video, and I'm unsure how much hardware acceleration it can use. Not much, I'm afraid.

Will I be able to view HD content with such a set-up, or should I upgrade the CPU? Would a serious graphics card help at all?

(Of course, most of the video won't be full HD, just up-scaled DVD, or 720p content 'found somewhere on the net'. But it would be fun to watch the occasional Blu-Ray, now that PC Blu-Ray drives are becoming reasonably priced.)

Note, I'm not interested in running Crysis, or doing any kind of real-time ray-tracing, which is why I've so far kept to my on-board graphics.

Thorsten Christiansson

O Yes, your onboard video will probably choke on some content, and a better graphics card – which is to say, pretty much any actual separate graphics card – is likely to help with that.

There are so many combinations of codecs, video hardware, driver versions and playback programs, though, that pinning down exactly what will and won't play back smoothly can be a pain. If I were you, I'd just buy my new monitor and start playing stuff, and see if it works; if and when something doesn't it's the time to buy more gear.

(Note that you also need to make sure that the HDTV you buy will actually work from ordinary computer input, without the magical pixie dust of HDCP sprinkled everywhere. More on this here: www.dansdata.com/io089.

htm#4)

Assuming that some HD stuff doesn't play smoothly on the new monitor – which is probable – then if the only problem is Blu-Ray, all you'll need is a graphics card with hardware-and-driver support for the melodiously-named 'H.264/MPEG-4 AVC' and 'SMPTE VC-1' codecs, plus Blu-Ray's dialect of MPEG-2, for older discs. Your built-in GMA X3500 graphics adapter actually does have VC-1 decoding built in, but for HD H.264 from integrated video you'd need at least a G45-chipset motherboard, or some other unusually muscular integrated graphics adapter, like the one on Nvidia ION boards.

Nvidia and ATI's GPUs and drivers have been able to handle Blu-Ray for some time (well, the Windows versions have); the drivers



also help with some other codecs, plus de-interlacing and colour-correction and so on. Nvidia call its version of this PureVideo; ATI call its one Avivo.

You don't need a high-end graphics card. GPU-assisted 1080p decoding was working nicely on GeForce 8800s at the end of 2006, and all sorts of unassuming fanless cards can do it now.

Nvidia has a PDF comparison chart here: tinyurl.com/DB4L8

...that tells you just how cheap you can get without losing Blu-Ray codec support.

Be prepared, though, to have to use more than one player program. If people were sensible then every player would work with every kind of content, but Copy-Control Crap and weird codecs mean that you're almost certainly going to need something in addition to VLC, like the Home Cinema mutation of Media Player Classic (<http://mpc-hc.sourceforge.net/>), and/or an actual licensed DVD/Blu-Ray player program like PowerDVD.

(You ought to get a licensed player bundled with your Blu-Ray drive.)



The smaller, the louder

I I recently bought a Compaq ProLiant DL360 G2 on eBay, with the intention of using it as my SmoothWall machine. It has a stonkingly LOUD fan that I am unable to slow down with software (because I don't know how to in SmoothWall). I was hoping I could solder on a few resistors and let them do the work, but I am not sure what I'm doing.

The fan is a 24Volt 0.65 amp behemoth, with four wires coming from it: Yellow, Red and 2x Black (though I suspect the black are spliced together on their way back from the fan, as only 1 black goes into it). My goal is to make the fan vaguely controllable so I can dial it right down to maybe 1/3 or 1/4 of its stock speed. Failing that, I'd settle for hardwiring it to 1/4.

Can you tell me what resistors I need and what wires I should be soldering them onto? I have a multimeter handy but am not quite sure what I should do with it.

Andrew Casey

O The DL360 G2 is a one-unit rackmount server, and those are often loud, if they've got high-powered hardware in them. There's no room for big fans in a case only 44mm high, so they instead have small fans and/or blowers, turning really fast.

It's possible that the fan's current-draw specification is the peak current when the fan's spinning up, not when it's running at a constant speed, but I wouldn't be surprised if it really was a $24 \times 0.65 = 15.6$ -watt fan. Which will indeed be very noisy, if it's not the size of a desk fan.

You can use Ohm's Law to figure out power-dropping resistors in a situation like this – but you don't necessarily actually want to, for the following reasons.

1: The fan may not even turn from a lower voltage. There's a decent chance that it'll turn from roughly half voltage, but there's no guarantee. It's also possible that the bearings may get stickier over time, so a fan that starts fine from lower voltage today will fail to start in a couple of years.

(Many, many people have for one reason or another ended up with fans that turn okay once they're going, but need to be poked with a pencil to get them started. It is important to remember to do this poking whenever powering up the device in question.)

2: The fan may be turning at this alarming speed for a very good reason. Cooling is a big problem for 1U servers, and if this one's using one fan for almost all of its cooling, turning that fan down may cause overheating in the short term, or early death of components in the long term.

If tinyurl.com/o6hy7 can be believed, this server seems to have some other small fans in the power supply. Those are either very thin fans of reasonable diameter, or little 40mm units. Either way, they won't



make a lot of noise by themselves, but may also not last very long. Small server fans shouldn't crap out after 300 hours like the similar-shaped fans in consumer hard-drive boxes, but they may.

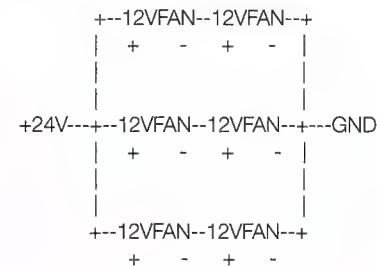
Fortunately, there are ways past all of these problems, provided you don't have to install this server in its intended habitat, a cheek-by-jowl rack with other hot gear above and below it. If you can give it plenty of breathing space – which you probably can – then you can just replace the standard fan with a much quieter outboard cooling arrangement.

Figure out where the air's going in and where it's coming out – including the power-supply-fan air-flow, so you don't end up trying to suck air in through PSU exhaust fans – then take the case off and hack holes in it to install normal PC fans in. You should only need to do this to the top panel.

With any luck, the server has a standard 12V fan socket or three on its mainboard. If not, no big deal; you could power 12V fan(s) from a separately hacked plugpack or old PSU.

You could even use the standard 24V fan rail to run 12V fans.

Two 12V DC fans in series will work fine from 24V DC, and the stock fan in your server has such a high rating that you could easily use SIX low-power 120mm fans (with 0.1-to-0.2-amp current ratings), in three parallel strings each containing two series-wired fans, presented in NetHack graphics below:



This many fans is unlikely to be necessary; two parallel-wired-series-strings-of-two-fans would probably give you more than enough cooling. Or if you wanted to get clever, you could use a single string of three series-wired 12V fans from 24V, so they'd each see 8V and run at roughly 44 per cent power. Most 12V computer fans will work A-OK at reduced speed from 8V; 6V is pushing it, but 8V is a good bet.

Yair, moite, I'm a Yank all right

I Are you aware of any secure way to buy mp3s from overseas services like Amazon without getting hit by the "You live in the backward Australian IP address range, and we don't allow sales of mp3s to that part of the world" roadblocks?

I figure the most likely solution is to use some form of proxy to defeat the region checking. My big problem is finding one that, one, is secure (free proxy lists don't fall into this category), two, presents an IP from an acceptable geographical region, and three, can be had for much cheapness.

Larry Narraway

O I think, but am not certain, that it's as simple as going to <https://www.amazon.com> via the Tor anonymity network, and using a Tor exit node in the USA (which is where most of them are anyway). Amazon lets you start out like that, by going straight to SSL-encrypted HTTPS, and https-via-Tor is I think as secure as https generally.

Alternatively, there are companies that'll sell you a proxy or SSH-tunnel service from wherever you are to where they are, like cotse.net (who is in the States). This is overkill for just buying MP3s, but a cotse account with all mod cons – and honestly, the feature list goes on and on and on, and includes other stuff you might like – only costs \$US5.95 a month, so what the hey. It should be fast, too.

Note that your credit card could be a problem too, if it's from an Australian bank. 



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Lies, damn lies, and benchmarks

Ashton Mills ponders the comparison between synthetic and real world benchmarks.

The inherent irony of performance benchmarking tools is that they only reflect the benchmark program itself. We forget that when we run the tool we just get to see how well that program, and only that program, runs on the hardware. The results cannot carry across to any other program or task – when people try to, they can only infer subjectively. You can't, for example, quantifiably say Crysis will run ten per cent faster on computer A over computer B because SuperMegaMark6000 ran ten per cent faster on computer A. The only test for how well Crysis will run on a machine is Crysis itself.

Which is why 'real-world' benchmarking like this is always more accurate, and more useful, than synthetic.

Users constantly have their machines doing many things at once, and there is no benchmark, for any platform, that emulates this.

And not just in games. Recently, in what I'll call *e-peen politics* a discussion on the LKML (Linux Kernel Mailing List) brought this to the fore. The LKML is where the gods of Linux kernel programming hang out, and there are seriously intelligent people here. One of them, an Australian named Con Kolivas, made a name for himself a number of years ago when he developed a series of patches (the '-ck' patches) that greatly improved performance for the desktop, a departure from the default optimisation for big business server systems. Con left the scene after a verbal stoush with luminaries including Linus Torvalds himself, and his code was never accepted into the kernel. It did, however, inspire the development of CFS, the Completely Fair Scheduler.

Con made a grand entrance this month, returning to the scene and bringing with him a completely new desktop-focused CPU

scheduler, and gave it a name no one could ignore: BFS, or the *Brain Fuck Scheduler*. Instantly die-hard tinkerers started playing with the patches. And it appears Con has again succeeded, as BFS running (on my machine at least) is blazingly fast and responsive compared to the default CFS.

With such an abrasive attitude, it was sure to illicit a response and the author of CFS, Ingo Molnar, posted a polite message testing out BFS compared to CFS with some interesting results: BFS beat BFS in every area. But this was quite the opposite of the results from people using it in the same thread. And therein lies the problem. The benchmarks measured raw performance in terms of throughput (or work) that the

of the real programs you run. And even benchmarks that *do* use real world programs (graphics, office, compression etc) in sequence are just as unreliable – because in the real world, the user is running all those programs *at the same time*.

PCMark, 3DMark, Everest, SuperPI, wPrime and the rest. Use them for the e-peen stakes, and use them for discrete subsystem performance comparisons, but remember they can all only ever benchmark themselves. There is no benchmark for the specific programs you actually use (except the program itself) or for complete system performance running a dozen primary and background programs at once, just how you really use your machine, at least not yet. Until then, take them with a grain of silicon.

We benchmarked Ashton once. But only once...
amills@atomicmpc.com.au

Schedulers do, but not interactivity.

But users don't notice work. They do, however, notice responsiveness. They notice when dragging a window suddenly skips due to some other background activity, or notice how long an application takes to load while decompressing a zip file. Users constantly have their machines doing many things at once, and there is no benchmark, for any platform, that emulates this. There's no 'Playing Crysis while downloading torrents with Firefox open and my MP3s playing'. As some comments posted to the LKML demonstrated, BFS allowed one user to play Doom 3 with no stutters or freezes while other programs ran in the background, something CFS couldn't do.

Benchmarks that focus on throughput miss the point of how people actually use their machines. Even if they use a variety of synthetic tests, they still can't represent the performance





PC BUILDING MASTERCLASS

It's all very well knowing which is the best motherboard and the fastest graphics card, but if you don't know how to put them together then your dream PC is never going to take shape. **Mark Mackay** shares the secrets you need to build a brilliant PC from scratch, with either air cooling or a liquid-cooling loop.

The majority of people who build their own PCs will concede that there was a time when the thought of getting in among all those circuit boards and wires was an intimidating prospect. The same people would also probably agree that once it's broken down into key parts, PC building is considerably easier than it initially appears.

There are, of course, different ways of performing the task, so the approach outlined in this article isn't the only way to build a PC. That said, we've got several decades of experience between us here at Atomic, and we're going to explain the techniques that we use to make the process as easy as possible. We're also going to throw in some advanced tips, and explain cover cable braiding, which is a great way to add a professional look to your build. Plus, in the Tutorials section of this issue, we even get in depth with setting up a custom water cooling rig!



Preparation

Preparation is an important step, especially for first-time builders. The first thing you'll need is your calming beverage of choice – an energy drink, cup of steaming Joe, or a beer (but not too much). If you're not a drinker of such things, then it's time to start. As crucial as a bevvie is, remember that liquid and hardware don't mix well, so keep it somewhere safe.

The next thing you'll need is a large table – a kitchen table, dining room table or large desk are all good candidates. Give yourself plenty of room, as this will prevent you from having to balance hardware and tools precariously to save space, or not having somewhere to put something down when you're holding two parts together that are to be screwed. Situations like this can stress you out, which can lead to

you losing your enthusiasm for a build. If this happens, it's the build that will suffer, so make it easy on yourself and find a big surface to work on.

If you don't have a large table, the floor will do. Either way – although especially if you're working on the floor – you should wear an anti-static wristband. They may seem like the sort of thing Ned Flanders would insist on, but they may just save you a boatload of pain if you zap your newly ordered hardware with static and build a PC that doesn't work. Statistically, the chances of static frying your hardware are minimal, but it isn't a risk worth taking. Seriously, do you want to have to buy a second \$500-plus GPU because you fried one with a single touch?

Your PC case will come with a box of bits and pieces. This is a useful tool for storing all the screws and other small parts the build generates. Keeping everything to hand in one place will save time and hassle. Make sure you have all your tools within reach; the last thing you want to do is leave the build at a crucial moment to grab some pliers or cable ties. Building PCs is one of those tasks for which you need to stay in a concentration zone.

Size up your case and be on the lookout for cable management possibilities and location options for your hardware. Forward planning such as this will make things easier when the time comes to add in a particular part or tie some cables for a particular component.

Benchtesting

While you're probably keen to get your PC built, it's best to assemble your PC's core components outside the case before installing them. This will save you experiencing the unhappy outcome of building your shiny new PC, hitting the power button and nothing happening, due to some of the components having been dead on arrival.

The motherboard box makes a good platform on which to sit your bench rig, so take out all the extras, such as the manual

and installation CD, and sit the motherboard assembly on top of the box. Then it's a case of installing the core hardware the system needs to power on – CPU, cooler, memory and graphics – and connecting this bare bones machine to a keyboard and monitor. After that, check that everything is working.

1 Insert the CPU

Installing the CPU is an easy process, although it varies, depending on whether you've taken the AMD or Intel route. AMD still puts the contact pins on the chip, whereas with Intel, these are situated on the board. Regardless of the CPU, though, you'll need to release the socket on the motherboard in order to fit the chip – this is achieved by releasing a latch (and then, on an Intel board, moving a metal cover out of the way as well).

Small grooves or nicks in the CPU's shape will make it slot into the socket like a jigsaw piece when the orientation is correct. In addition to this, one corner of the CPU will be labeled with a small triangular arrow. The same arrow design is usually printed on the socket, so getting the CPU the right way around is a case of matching up the two triangular arrows in the same corner. There's only one way for it to fit, so don't attempt to force it. When you get it right, the CPU will fit snug with the socket.

Once this is done, pull down the retention bracket and clip it in place with a latch (on an Intel board), or simply pull down the latch if you



THE RIGHT TOOLS FOR THE JOB

In all honesty, you can build a PC almost entirely with nothing but a No.2 Phillips-head screwdriver. However, this isn't to say that there aren't a few other tools that will help to facilitate the process. The cost of building the majority of PCs will run into at least a thousand bucks, so spending a few more quid at your local hardware store shouldn't break the bank. Here are some of our favourite tools for making building that much more fun.

NO.2 Phillips head screw driver

A PC builder without one of these bad boys is like a knight without a sword or Ghandi without slippers – you're going nowhere fast. While it isn't impossible to build a PC without

a magnetic-tipped model, we'd strongly recommend using one if you don't want to worry about screws becoming loose.

Wire cutters

Just like those seen in Counter-Strike, a good pair of wire cutters is invaluable for all things cable management.

Needle-nose pliers

Even the most slender of hands would have trouble reaching the most remote corners of the average PC chassis to reach cunningly positioned cable ties. A pair of needle nose pliers will get you out of many a jam and give you access to tight cubby holes for tidying.

Snub-nosed pliers

Owing to their shorter pincers, snub-nosed pliers are better for achieving a solid grip than their needle-nosed siblings. If you need to pull a cable through a tight hole that's easy to reach then this is the tool for the job. The great control of the snub-nosed variety makes them worth having to hand.

Cable ties and bases

These ingeniously simple bits of plastic speak for themselves; they're the key to a tidy PC. You can pick up large packs for small amounts of money from just about any home hardware store. Their low cost means that they're great for experimenting with to develop your cable-tidying prowess.



have an AMD board. This will usually take a little force, which can make it seem like you're doing it wrong. As long as the CPU is sitting in correctly in the socket, there's nothing to worry about. The pressure applied to the retention arm ensures that the CPU has a solid contact with the pins underneath.

2 Applying thermal paste

The next step is attaching a cooler to the CPU. Most cooling systems rely on a large copper block attached directly to the chip, whether they dispose of heat using liquid or fans. The more efficiently the block transfers heat, the better the entire cooling system will perform. Tiny cracks and grooves on the underside of this block can impede efficiency, but spreading a small layer of TIM (thermal interface material) over the chip's surface can fill these in and reduce your CPU temperature dramatically. Many heatsinks are sold with a layer of grey TIM included, which is usually sufficient.

For the most effective cooling, a better option is to wipe off the manufacturer's TIM from the heatsink using kitchen towel and a few dabs of TIM cleaning solution, and apply your own TIM. Applying the TIM can be nerve-wracking, as it's one of the few parts of the build that requires human judgement. You really don't want to apply too much, as it can start to

act as an insulator rather than a conductor.

The first step is to apply an amount of TIM that's roughly equal to a garden pea to the CPU. There are two methods you can use to spread the TIM evenly; you can wrap your finger in Gladwrap and use it to spread an even layer on the top of the chip, or you can simply place the blob of TIM in the middle and rely on the pressure of the heatsink to spread it. Both methods have their advantages. By manually spreading the TIM to achieve a smooth layer over the whole of the top of the CPU, you know that the whole of the chip is covered. If you make sure that it's smooth, you'll avoid cracks or gaps in the layer; these can form air pockets, and insulate heat instead of transferring it to the cooler. On the other hand, the blob-and-spread method is advocated by certain manufacturers, and logically, should push TIM to where it's most needed. Testing the difference between the two would be very difficult, as TIM takes time to cure and temperatures will differ between CPUs. However, taking the time to carefully apply TIM will certainly give your custom-built PC an advantage over the bland boxes built by larger system builders.

3 CPU cooler

Once you've applied the paste, next up is the CPU cooler. HSFs vary in terms of how they need to be fitted, but we can offer some general advice that will help with most of them. Firstly, when unboxing the cooler, be careful, as they frequently have lots of small, fiddly screws and brackets, and you don't want to lose them. Secondly, RTFM (Read The F'in Manual). It can be rather tedious but most companies have been in the CPU cooler business for years and are pretty good at supplying clear, concise instructions. It's also worth checking their websites – companies such as Zalman post video or animated tutorials online.

CPU coolers for Intel systems will have four screws or push-pins, once in each corner. If this is the case, when you've pushed or screwed the first one, make sure to follow up with the

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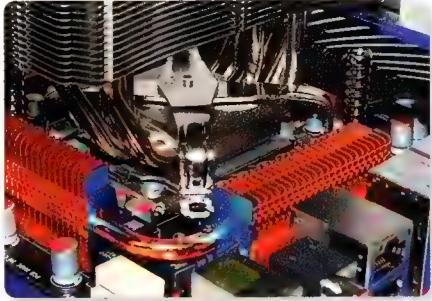
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lined up with the rut. When you're happy with the orientation, slot one end of the DIMM into the corresponding end of the slot. When it's held in place by the slot, do the same with the other end and apply pressure until the plastic retention clip clicks into place.

You should also pay attention to the slots you're using for the memory – they're usually colour-coded to indicate the order in which the slots should be used. Installing DIMMs in the right slots enables the memory to run in multi-channel mode for some CPUs. Check the manual for your motherboard to find out which you need to use.



screw or pin in the opposite corner. If you insert two pins or screws on one side, the second two will be much harder. Similarly, if your model uses screws, make sure not to tighten them all at once – instead, tighten them separately, and by small amounts at a time, as this will make the heatsink far easier to install. Once the heatsink is installed, don't forget to connect the fan to the motherboard. You should find a 4-pin connector handily positioned near the CPU socket.

4 Memory

Memory is undoubtedly one of the easiest parts of a PC to install, replace or upgrade.

DIMMs have a small notch cut out in their circuit board that lines up with the DIMM slot. Hold your DIMM above the slot to make sure you have it the right way around, with the notch

5 Early testing

Insert your graphics card into the correct 16x PCI-E slot. As with memory, the 'primary' slot for a single graphics card system varies, and the motherboard manual will reveal this, but for the majority of boards, it's the slot closest to the CPU socket. The card will only fit one way but make sure that the backplate of the graphics card is slightly off the edge of the box. If not then the backplate will prevent the card from sitting flush with the slot; all of the card's gold edge connectors should be pushed into the plastic slot.

Now place the PSU on the right-hand side of the box (making sure its fan is unobstructed). Connecting the PSU to your hardware is as simple as matching the ports on the kit to the corresponding shaped plugs. PSU plugs are subtly asymmetrical, so they'll only fit in one way. Any plug that isn't right for a certain piece of hardware simply won't fit.

There are three power connectors you need to hook up for this first part of testing: two for the motherboard, and one for the graphics card. The motherboard requires a 24-pin ATX connector, and if it's a new, high-end model, an 8-pin EPS connection (4-pin on older boards). Graphics cards require anything from a single 6-pin PCI-E connector to two 8-pin connectors, or even none at all if you have a low-end model.



Connect a keyboard (you can leave the mouse for now), and the screen to either of the outputs on your graphics card. With no case power switch attached, you can turn the PC on by shorting the header on the motherboard. This is best done using a biro or small screwdriver, and you simply touch the pins using the small metal area at the nib of the pen. Don't worry – this isn't dangerous. When the computer powers up, the PSU and CPU fans should kick into life. Wait until the BIOS screen appears. It may notify you that the CPU has changed, which is normal. Press F1 to skip through this, and the PC will hopefully finish its POST sequence.

Reboot, and enter the BIOS. You should be able to find a page where the BIOS is monitoring temperatures (often called PC Health status or something similar). Look for the CPU temperature – wait a few minutes after starting the PC to allow it to stabilise. For the CPU and heatsink combination we're using, a temperature higher than 45C suggests that something isn't right. If this happens, switch off the computer, unplug the PSU from the wall and check that the HSF is securely fitted.

In a perfect world, everything will have worked as described and you can install the PC in the case. Unfortunately, you could encounter



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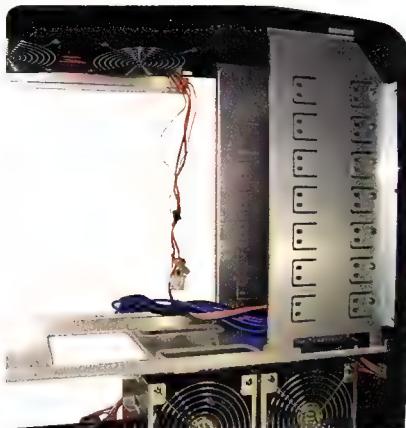
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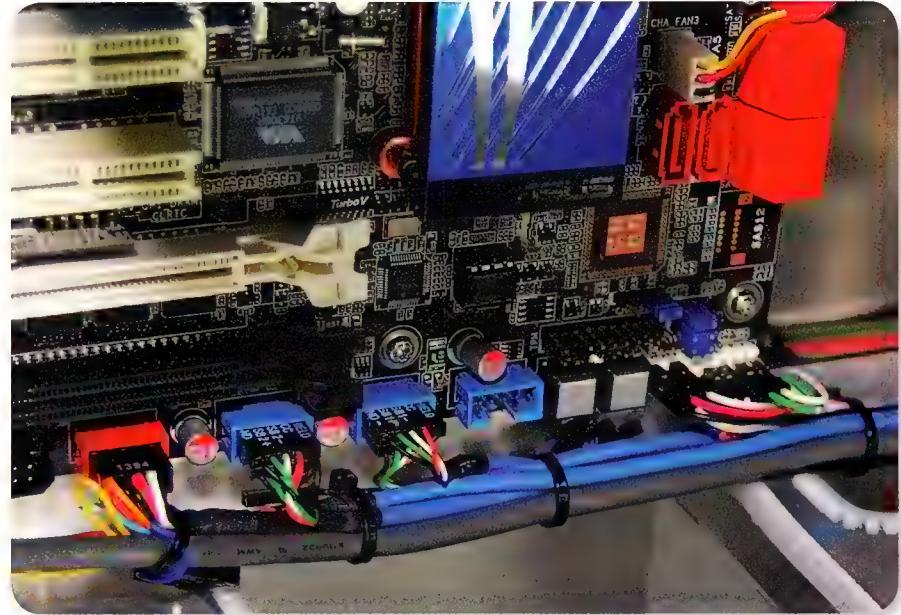
any number of problems. The PC might not turn on, or it may sit and beep at you. We'll cover off on some standard problems – and their fixes – next issue.

6 Case

Once everything is working, it's time to unbox the case. Before you start trying to install the motherboard in it, there are a few steps that you can take now that will make the build process easier in the long run.

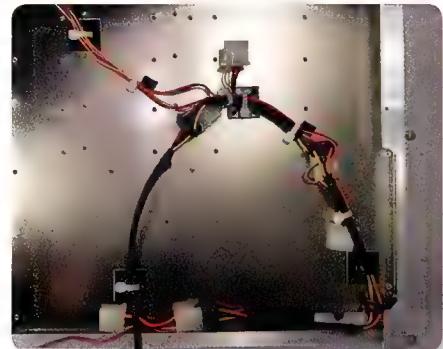
For example, if you're going to use different fans than the models that your case shipped with, now is the time to install them. It helps to have an idea where your cables are going to go, and to install the fans in such a way that the cable will take the shortest route to its destination. For example, if you're going to route the cables to a fan controller that you're planning on installing in one of the front 5.25in bays, you don't want the fan cable on the outside of the fan chassis, so it stretches over the motherboard. If there are any unwanted extras in the case that you don't plan to use (such as drive caddies), remove them.

NOTE: Now it's time to make a decision: if you're building an air-cooled system, carry on to step 7. If you're water-cooling your computer, skip ahead to page 78.



7 Motherboard

Before installing the motherboard assembly in the case, you'll have to screw in the standoffs. Entirely unlike the Mexican variety, standoffs are brass bolts (supplied with the case) that put distance between the back of your motherboard and the motherboard tray to avoid short-circuiting your hardware. Different form factor motherboards have their screw holes in different positions, so if you're unsure then simply hold your motherboard over the motherboard tray and check the positions. Once the standoffs are installed, it's a case of screwing the motherboard to them. It's a good idea to start with the screw at the top left of the motherboard tray as this will help to hold the motherboard in position and make it easier to add the rest of the screws.



positions of the fans and determine which ones have cables that can be routed together along the same path. You want to bunch cables together as much as possible to make the least amount of mess, and improve interior airflow.

Next, it's time to connect the front panel connectors. Look up a diagram in the motherboard manual that explains the front panel pins and then match them with the connectors wired to the case. There will be a '+' and a '-' on the diagram, which is usually also denoted on the connectors. If not, then the colour of the wires gives you a clue too. The coloured cable is the positive, while the white or sometimes black cable is the negative.

Wires for front USB, FireWire and audio connectors all need to be connected to the motherboard, and all have a blank guide pin on their connector, ensuring you connect them correctly. Find the relevant place to connect them to the motherboard (again using the manual) and carefully plug in the wires.

8 Preliminary cable management

It's best to start the cable management prior to adding the PSU. The idea behind this is that rather than adding a whole bunch of cables to the build, it's better to tidy the ones that are already present first. This will save you having to work around dangling fan connectors and front panel wires snaking around the interior. Tidy them up first, and then deal with the PSU cables later on.

The stock fans in the SilverStone TJ07 we're using for this build have a Molex connector for power, in addition to a wire with a 3-pin fan header. The latter is so the motherboard can monitor and vary the fan's speed. If your fans have Molex connectors (which will plug directly into the PSU), route the cables around the back of the motherboard tray so that they can be connected when you install the PSU. If not, start connecting them to the motherboard's fan headers or your fan controller. Look at the



9 Expansion cards and optical drives

These are very much plug-and-play devices and shouldn't need a great deal of work to install. Installing the graphics card follows the

CABLE BRAIDING

Braiding is a cheap and easy way to give your PC a professional look. Most new PSUs are braided in black, which can make other cables in your case stand out like Tetris players on a CoD4 server. Braiding blends them in with the other cables and makes the whole caboodle look like an awesomely nerdy work of art.

SATA cables

You can braid pretty much any cable in your PC. The easiest cables to braid are the SATA cables, so we'll start with them. Braiding two standard SATA cables requires about a metre of 10mm braid.

As the SATA connectors themselves have sharp corners, the first step is to file them down slightly. This will let the connector slip smoothly through the braid without being snagged on the edges. Be careful not to shave off too much, otherwise the connector won't sit snugly into the port on the hard disk or the motherboard. Once the corners are smoothed out, tease over the braid and snip it off at the appropriate length using scissors.

Next up is shrink wrap, which neatly finishes the braid and keeps it secure on the cable. For SATA cables, 20mm shrink wrap works a treat, as it fits over the connectors. Snip a length of the shrink wrap and slip it over the SATA connector. It's best to cut all the bits of shrink wrap to equal lengths before applying them to the braid to ensure they look as neat as possible.

For it to perform its shrinking magic, the shrink wrap needs warming up. For this, you can use a lighter, heat gun or stove. Whichever heat source you use, start off by holding the shrink-wrapped cable a good distance away and watching the effect it has. This approach will give you a feel for how much heat will be necessary to form it into shape. Once the shrink wrap has a comfortable fit over the end of the cable, you're done.

same process as used when we were testing earlier, except that this time you'll need to remove a few backplates from the case, and screw in the card to secure it. The same applies for other expansion cards, like soundcards.

It's a good idea to ensure that there are a couple of slots worth of space between the graphics card and any other expansion cards (such as sound or networking ones), so as to allow the graphics card's cooler room to breathe. In builds with lots of expansion cards (or for motherboards with very few or poorly placed slots), this isn't going to be possible, but if you have the option, leave some space. Once the expansion cards are in place, secure them with the screws that were previously holding the backplate in place.

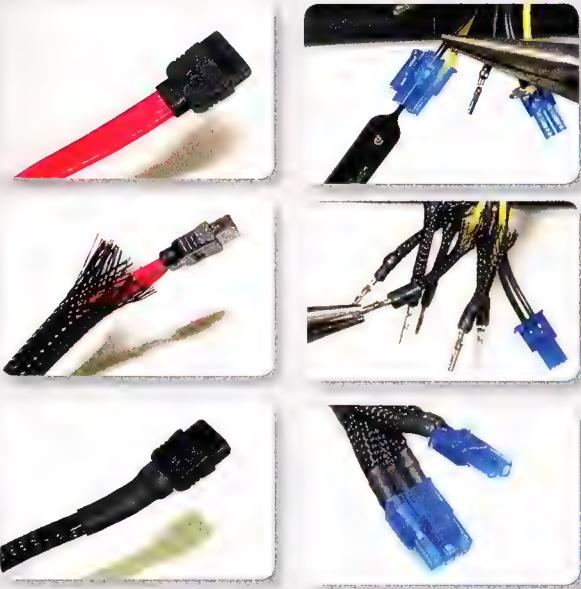
To install the optical drive, remove a bezel from the front of your case and slot in the optical drive. Two screws on either side will hold it in place.

Power cables

You can also braid your power connectors (such as the 24-pin ATX or 6-pin PCI-E connectors) in order to hide any exposed wires. This can make your connectors look awesome but the process can become very time consuming and requires a good deal of patience. It's so time consuming, in fact, that we wouldn't have been able to finish the feature on time if we'd done this with every cable in our PC.

First, you need to remove the connectors; to do this, we used Sunbeamtech's PSU Modding Toolkit. It features a pair of micro pliers, which are specifically made for the job. Insert the pliers so that they sit either side of the pins. This flattens out the tiny wings on either side that hold them in place in much the same way as a fishing hook is held in place in a carp's mouth. Once the pliers are in, the wire will pull easily away from the connector.

Next, use a pair of scissors to snip off the PSU's stock shrink wrap. Then, using lengths of 3mm braid and 6mm heat shrink, use the same process as with the SATA cables above to cover the wire – braid first, then heat shrink to finish neatly. Holding the metal pins with pliers while you heat the



shrink wrap is a good way to avoid burning your fingers. Once all the wires are wrapped, tie them together with a short length of 20mm heat shrink.

When that's done it's time to add the connector back. To make sure that you insert the pins in the correct order, keep another PCI-E power connector to hand. Inserting the pins back into the 24-pin power connector isn't as easy, as all the pins are different colours and must be replaced to their precise original location. To ensure you get it right, refer to your PSU manual for a diagram showing where each pin belongs.

10 Hard disks

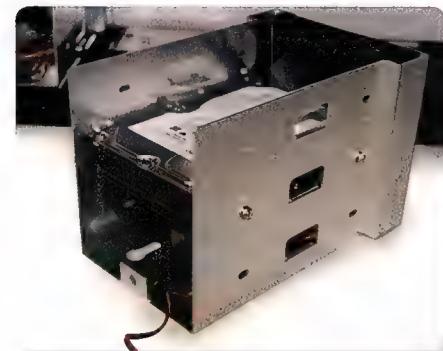
Different cases utilise different

methods of hard disk installation. Some use the simple method of four screws to secure the drive in a 3.5in bay. Increasingly, tool-less bracket systems are used instead, though, which should be even easier than screwing in four screws. Referring to case manual will point you in the right direction. Generally, you'll need to fit rails to either side of the hard disk, or place it in a caddy, and then slot it into the right place in the case. Whatever you do, make sure it's secure – the last thing you want is it moving around if you move the case or it gets bumped.

Much like installing expansion cards, it's a good idea to leave breathing room between hard disks where possible. Most cases will have an intake fan placed immediately in front of the hard disk bays to suck cool air in over them, and some space between them will help

to facilitate this. Installing hard drives is another one of those times where it's good to get each screw a few rotations in before starting to tighten them all.

You now need to connect SATA data cables to the hard disks and the optical drive, and then connect these to the motherboard. Be careful





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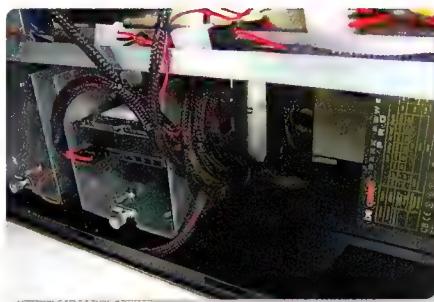
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when you're handling these connectors, as too much pressure can snap off the end.

11 PSU

To make things both easy and tidy in your build, it's best to use a modular PSU. This will allow you to only install the cables you need and not have to deal with a tangle of unnecessary wires and connectors that have to be stuffed away somewhere. Install the PSU in the case's PSU bay and secure it in place by screwing it in at the back of the case. Figure out which cables you'll need for your motherboard, expansion cards, optical drives and hard disks, and attach them to the PSU.

12 Cable management

You should now take stock of your case's nooks, crannies and cable management features. As mentioned at the beginning of the feature, you should have been sizing up the case and thinking about how things might pan out, and which parts you might be able to use for routeing cables. Apply ideas that you may have formulated during the build so far.

Some cases such as the Antec Twelve Hundred have holes cut into the motherboard tray that allow you to route cables around the back, which keeps the case looking neat and maximises airflow. However, this won't always be an option. In these circumstances, the best approach is to bunch the large cables such as the 24-pin ATX power and 6-pin PCI-E connectors together. Route the bunched cables in the general direction of the sockets and then direct them to their connector at the appropriate place.

As you attach the connectors, look at the route the cable has taken with a critical eye to see if it could perhaps take a stealthier route

through the case to its destination. Work on one cable at a time and experiment with a few different positions until you're happy that the cable is out of the way and looks smart.

13 The final step

Now that all the hardware is set up and ready to go, it's time to install Windows and enjoy the fruits of your labour. Before you can do this, though, you need to set the BIOS to let you boot from your Windows install DVD and, if you're using a sound card, disable on-board sound. Connect a keyboard, mouse and a monitor to one of the graphics card's outputs, then turn on the PC and head into the BIOS. Check that the motherboard has detected the CPU and memory, and is running them at the correct speed. Enter the System Information menu, and ensure the information is correct.

Now check that it has correctly detected the DVD-ROM and hard disk. The BIOS should list these in the Standard CMOS Setup menu. The order they're listed doesn't matter, as you can specify the drive on which to install Windows. You'll need to set the boot priority so that the computer first tries to boot off the DVD before loading files from the hard disk; in its default state, trying to boot from the hard disk would result in the error message 'Missing Operating System'. Go into the Advanced BIOS Options menu and select the Boot Priority option. Make sure that the CD-ROM option is listed above Hard Disk.

Save and quit, and then let the machine

boot. When prompted, press a key to load from the DVD. At the time of writing, Windows 7 is all but released. It follows an installation process similar to that of Windows Vista, but it's even easier and quicker. Back in the days of Windows XP, installing the operating system was a somewhat cryptic task. These days, it's much more user-friendly and the disc will take you through the process step by step.

And once that's done... game on, mof! You can either get to tweaking the bejesus out of your system (and we have a special Nehalem overclocking guide on page 60), or get to work on your fast liquid cooling project (and we've got another guide on page 78).

Or, you know, you can just fire up your favourite and game and see how much pretty it looks on your new system – and it'll look even prettier knowing that you've built it yourself.



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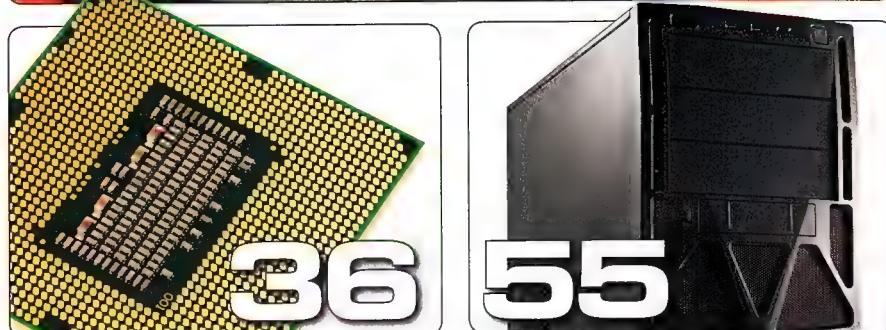
NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

We love the end of the year – it's when all the really cool stuff starts coming out, and this year we're blessed with some truly awesome tech.

We're still recovering from the goodness that is Intel's new Lynnfield range, so we've got more of that, plus more P55 mobos this month. But what's really floating our boat is AMD's

new 5870 graphics card – not only does it look like the old Batmobile from the Adam West TV series, but it's simply the fastest, gruntest card we've ever looked at.

And we're madly in love with Lian Li's latest enthusiast case – if we could marry a piece of hardware, we'd be honeymooning with this sexy beast right now.



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Heroes Season 3 has just hit the streets, and we're keen as punch to offer you a chance to win one of five copies of this superheroic television series. Fancy your chances?

www.atomicmpc.com.au/competitions

Intel Core i5 750

Budget LGA1156 champ.

Street Price \$270 Supplier Intel

Website www.intel.com

Specifications 2.66GHz quad core; 45nm manufacturing process; 'Lynnfield' core; 32KB L1, 256KB L2, 8192KB L3; 20x multiplier; 95W TDP; LGA1156.

When we got our excited selves together with Lynnfield last issue, it was so impressive that it took the top spot in Kitlog as our most coveted chip. This one isn't aimed at enthusiasts quite so much, but the Core i5 750 is rather a more mainstream chip that comes in at a bargain-basement price of only \$270! Considering the 870 currently sells for \$770, this is impressive, and the excitement doesn't stop there.

Manufactured on the same 45nm process and based around the same Lynnfield core as the other members in the LGA1156 family, this chip packs 774 million transistors into a die size of only 296mm². It retains the same cache structure as the top-end chip, with 32KB of L1 for each core, 256KB of L2 for each and a shared 8MB pool of L3 cache that each core 'fights' over to get as much or as little as they need, depending on processing load. Also packed into the core is a PCIe 2.0 controller that sports sixteen lanes for single or dual GPU configs (in dual 8x), as well as a DDR3 memory controller. While the controller is only two channels compared to Nehalem's three, real-world performance shows an almost insignificant difference. The memory ratio is also slightly crippled, and the maximum multiplier of 10x means that only 1333MHz DDR3 is available at stock speeds.

Running at a stock speed of 2.66GHz (133MHz x 20), it's got a locked multiplier that didn't prove a hindrance to overclocking – since the 20x multi has proven to be the best multi for high clocks. Where this chip does skimp on is Hyperthreading, which provides two threads per core for all chips



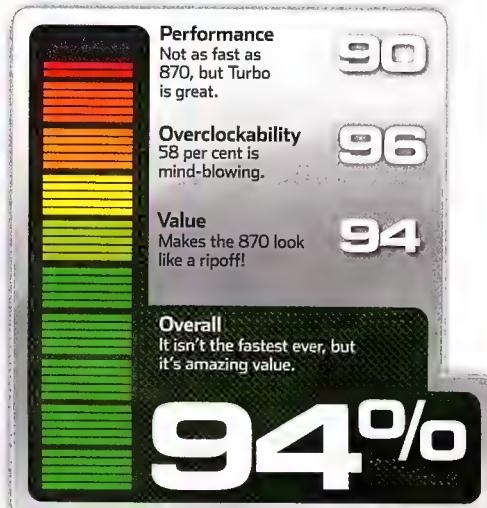
in the i7 series, and here is quite missed. It also doesn't have Trusted Execution Technology, a hardware feature designed to minimise data being compromised, but its inclusion is pretty non-essential. Turbo Mode makes an appearance here, but thanks to the lower stock clockspeed and TDP of 95W we found in testing that it actually did something useful!

At stock Turbo scored a PiFast run of 27.66s, turned off it hit only 32.93s. A run of wPrime with Turbo managed 40.574s, without Turbo it only scored 48.687s. The extra almost 20 per cent performance increase can be attributed solely to the multiplier kicking itself up to 24x under load – hitting a 3.2GHz overclock automatically! Once finished, it kicked itself back down to 6x, saving plenty of power. This was most noticeable in singlethreaded apps, and with the extra heat load under multithreaded apps it didn't get boosted much at all. Still, free performance is awesome.

Slapping the 750 into the GIGABYTE P55-UD4 – a pretty good example of a price point that most people would buy at – we got around to overclocking and found it an

incredibly inviting experience. It hit 175x20 easily, and kept pushing all the way up to a whopping 210x20 at 1.392v (1.425v BIOS) for a final speed of 4.2GHz – a 58 per cent increase! This is only 46MHz shy of the 4246MHz that the i7 870 got, and a fantastic result for a chip that is \$500 cheaper.

Our best guess as to the overclocking prowess is simply that Intel's manufacturing is so polished that it is making a huge amount of great cores – and to fill out the lineup there are good cores being binned as 750s that could potentially be 870 chips. What this means is that there's not really much of a reason to jump to the 870 chip unless you're doing anything with heavy multithreading, and even then the four cores have got you bloody well covered.  JR



Intel Core i5 750

	133x20; DDR3-1333 8-8-8-24	150x20; DDR3-1200 8-8-8-24	175x20; DDR3-1400 8-8-8-24
PiFast	27.66s	27.80s	25.01s
wPrime 32M – single thread	40.574s	40.948s	36.973s
wPrime 32M – multi-thread	11.856s (5.29x efficiency)	10.513s (5.23x)	9.608s (5.27x)
CineBench R10 64-bit – single thread	4228	4472	4988
CineBench R10 64-bit – multi-thread	14628 (4.08x efficiency)	16009 (3.58x)	18038 (3.62x)
Everest Read	15180MB/s	12843MB/s	14670MB/s
Everest Write	12368MB/s	10855MB/s	12606MB/s
Everest Latency	53.4ns	52.8ns	46.6ns

ASUS Maximus III Formula

Great stuff, but at a great cost.

Street Price \$466 Supplier ASUS

Website www.asus.com.au

Specifications Socket LGA1156; Intel P55 chipset; ATX form factor; 3x PCIe x16; 2x PCI; 2x PCIe x1; 10x SATA; DDR3-1600

Gallery www.atomicmpc.com.au/?155678

By the time you've picked up this issue, Intel's P55 chipset and matching LGA1156 CPUs will have been released to the market, ready for you to snap up. If you missed the review of the Core i7 870 last month, a quick summary of it is "better than God" – and better than Nehalem too. There's no reason to nab X58 for now, so let's have a look at ASUS' Maximus III and see if it can best our current board of choice; the ASUS P7P55D Deluxe.

Part of the Republic of Gamers series of boards, the Maximus III comes stock-standard with a glossy black PCB dotted with bright red PCIe and memory slots, mixed with grey expansion slots and black/red heatsinks. In fact the colour scheme here is pretty awesome, and it definitely looks the part. A badge sitting in the middle of the mobo lights up with a subtle red glow, itself linked to the PWM heatsinks via a small flattened heatpipe. There's a huge amount of power phases around the LGA1156 socket that add up to 16 total, each solid capacitor sheathed in a dull silver colour.

Four DDR3 slots for dual-channel memory sit near the socket and leave plenty of room for big

ROG Connect

Included in the I/O panel is a button and USB port that links with software running on the OS and an external laptop to allow controlling of overclocking settings – theoretically taking any additional stress of running software and moving it externally. This is a little silly, but might prove fun to play around with. Serious overclockers will stick with the BIOS, however.

ASUS Maximus III Formula

	I7 870 133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
PFast	27.52s	24.35s	21.53s
wPrime 32M – single thread	40.311s	35.833s	30.734s
wPrime 32M – multi-thread	7.754s (5.20x efficiency)	6.894s (5.20x)	5.897s (5.21x)
CineBench R10 64-bit – single thread	4521	5069	5913
CineBench R10 64-bit – multi-thread	18280 (4.04x efficiency)	20666 (4.08x)	23859 (4.04x)
Everest Read	14359MB/s	14940MB/s	15643MB/s
Everest Write	10879MB/s	12234MB/s	14256MB/s
Everest Latency	47.1ns	45.6ns	43.9ns



heatsinks, using a handy latching system that clips on the top side exclusively – meaning that graphics cards can't interfere with module changing. The 24- and 8-pin power connectors are placed along the edges of the board, with a 'ProbeIt' strip of voltage measurement points near the 24-pin connector inviting you to check the voltage with a multimeter. While this is a nice feature for overclockers, it's also not very invasive if you won't use it, being only ten small holes wide.

Six right-angled SATA ports and four vertical SATA ports (run off two external chips) lie at the bottom of the board, with no IDE or Floppy connectors available. The P55 Express chipset lies underneath the black rectangular heatsink, which didn't get particularly hot under load. Hard power and reset buttons lie along the bottom of the mobo, with USB headers and three fan headers (a total of seven fan headers are on this board).

Expansion slots are quite well fleshed out, the two red PCIe slots working as dual 8x in Crossfire or SLI. The lower white PCIe slot will run at 4x mode off the P55 Express chipset, and is quite

limiting. Four Packet Switch chips below the top PCIe slot allow automatic changing of PCIe lanes depending on what devices are installed.

I/O options are quite limited compared to some boards, with nine USB, PS/2, Clear CMOS, Firewire, eSATA and Ethernet included. The audio is moved to an external riser card, needing one PCIe 1x slot to run.

Running the latest BIOS from ASUS gave this board a very slick feel, each option quite detailed and responsive. The highest speed at the stock 22x multiplier of the i7 870 was 176MHz, but dropping it to 20x gave a final maximum speed of 209MHz (4180MHz). This is slightly higher than the P7P55D Deluxe that scored 20x205MHz, but lower than the GIGABYTE P55-UD6 that hit 22x193 for 4246MHz. Considering the \$55 price jump for an extra 4MHz that would likely be added by a BIOS update, the Maximus III is an extremely nice board – but not the best. 



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GIGABYTE P55-UD4

A racecar called GIGABYTE.

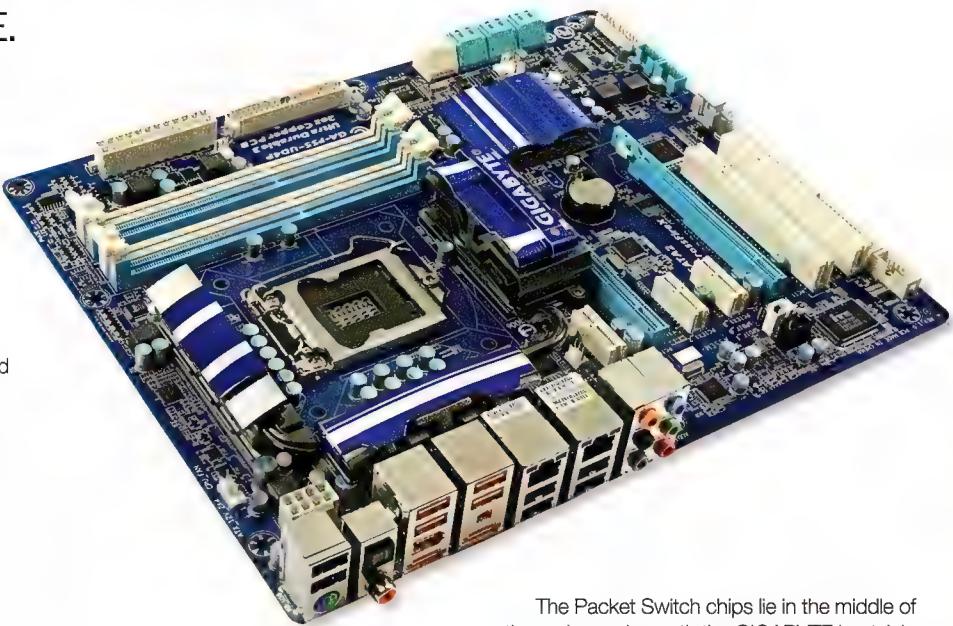
Street Price \$224 **Supplier** GIGABYTE
Website www.gigabyte.com.au

Specifications Socket LGA1156; Intel P55 chipset; ATX form factor; 2x PCIe x16; 2x PCI; 3x PCIe x1; 8x SATA; DDR3-1600

GIGABYTE's ultra-premium offering was a great overclocker last issue, but the performance missed out on quite a few marks. The P55-UD4 is its midrange mobo, sitting exactly where most people throw their cash and possibly where you'll be spending yours – but think twice before leaping in. Thankfully, that's what we're here for.

Based around the P55 Express chipset, this motherboard is afforded a lower cost thanks to the single chipset needed compared to traditional mobo setups. While prices are hovering around \$224 at the time of writing, they'll fall in the coming months as competition rises closer to Christmas – so keep your eyes open for good deals. The LGA1156 socket has quite a lot of room around it, though taller heatsinks might find that they brush up against the PWM heatsinks (though a TRUE fit's fine). Two DDR3 channels give this mobo four physical slots to install memory sticks up to 8GB total, while the 8-pin and 24-pin connectors are placed in the usual spots for easy access.

The budget spin of this board is pretty clear from looking at it, which has many wide open spaces bereft of solid capacitors or ferrite chokes. This isn't particularly a bad thing, since less components means a simpler and hopefully cheaper board. Even though some features are omitted here, there are still a very handy eight right-angled SATA ports (two off an onboard chip) as well as a single IDE connector. Front panel headers lie along the bottom with two USB and a single Firewire, though the audio header is behind the I/O panel. There's a total of five fan headers across the mobo that give plenty of cooling potential, even though



the mobo doesn't really need it – heatsink arrays remained quite cool under load without additional fans. Definitely chuck a fan or two on when overclocking however, because it can warm up noticeably.

Expansion options are pretty great, with the two blue PCIe slots working in dual 8x mode under Crossfire or SLI. The lower slot is physically 16x, but is electrically limited to 8x. Thanks to the P55 chip's spare PCIe lanes, there are three PCIe x1 slots that can be used for whatever takes your fancy. Audio duties are taken care of by a Realtek ALC889A chip, which is quite good.

I/O options cover a whopping ten USB, one PS/2, Optical/Coaxial, 6-pin Firewire, 4-pin Firewire, two hybrid eSATA/USB, two gigabit Ethernet and 7.1 channel audio. There seriously can't be anything more packed in here and the only thing missing is a Clear CMOS button to help with overclocking, which was quite disappointing.

The Packet Switch chips lie in the middle of the mobo underneath the GIGABYTE heatsink, while the P55 chipset is cooled by the small heatsink in the bottom-right corner. Obviously styled like a racecar, the performance of this mobo was more like a V12 truck being fed by a 600mL bottle of petrol – good, but limited. At stock speeds it doesn't seem to compare to ASUS' performance, and while just like the UD6 it catches up at the first OC step but falls behind at the second. This isn't just by a little bit – it loses two whole seconds in PiFast as well as other drops, which is quite disappointing.

Overclocking performance was great though, hitting a max of 209x20 for a speed of 4180MHz. The chip can do 4246MHz, so this is pretty darn close for a board half the price of the premium offerings. While its performance isn't quite up to scratch compared with other choices, for a cheaper alternative it's a very tempting board.

— JR



GIGABYTE P55-UD4

	i7 870 133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
PiFast	29.72s	24.46s	22.85s
wPrime 32M – single thread	44.131s	35.882s	33.557s
wPrime 32M – multi-thread	8.519s (5.18x efficiency)	6.909s (5.19x)	6.428s (5.22x)
CineBench R10 64-bit – single thread	4125	5068	5442
CineBench R10 64-bit – multi-thread	17139 (4.16x efficiency)	20908 (4.13x)	21669 (3.98x)
Everest Read	14668MB/s	14923MB/s	15498MB/s
Everest Write	10716MB/s	12177MB/s	14066MB/s
Everest Latency	47.6ns	45.6ns	44.2ns

Foxconn Cinema II Deluxe

mATX media mobo with room to move.

Street Price RRP\$199 Supplier Altech
Website www.altech.com.au

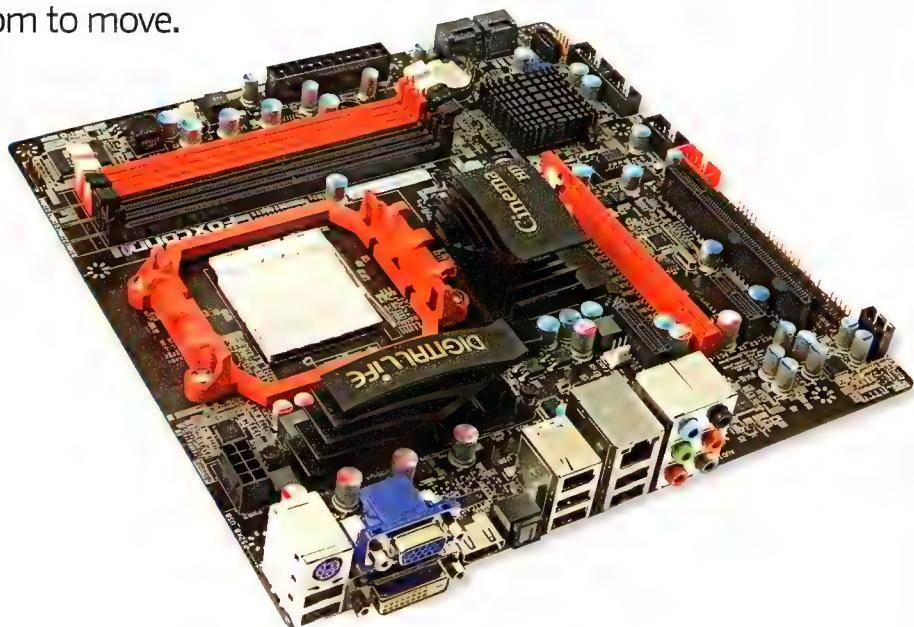
Specifications Socket AM2+; AMD 785G chipset; mATX form factor; 1x PCIe x16; 1x PCI; 2x PCIe x1; 5x SATA; DDR2-1066

AMD motherboards are curious beasts at the best of times, sometimes littered with so many features that you'll never use half of them, or devoid of anything actually useful. Foxconn's Cinema II is sort of halfway between those two points, but there's quite a lot here to like – especially for the upgraders out there.

Based around AMD's brand-new 785G chipset, this board uses an AM2+ socket rather than an AM3 socket. Restricting memory to DDR2 here doesn't mean that AM3 CPUs are excluded, and they work just fine. It's a tempting upgrade path for those who still have AMD chips that work, or who want to throw together a cheap HTPC. The 785G also comes with a cool feature; a completely integrated graphics core that is roughly equal to a HD4200. While it's never going to be able to pump out Crysis at full detail, it's fast enough to munch through 3DMark06 and give a score of 2066, taking tiny bites that mean it's only really good enough for older games. The real strength of this integrated core is high definition video, something it does very well.

The I/O panel helps here too, packing in six USB ports, a PS/2 port, DVI, VGA, HDMI, Optical, 6-pin Firewire, Ethernet and 7.1 channel audio powered by a Realtek ALC888 chip. All three display outputs can be used concurrently, with the two digital outputs being powered by HDCP, and audio being embedded in the HDMI output.

The space around the AM2+ socket is pretty clear, and there is plenty of room for lower heatsinks – though the TRUE used in testing scraped against the northbridge heatsink. Each heatsink is quite tall and designed with multiple levels almost like the veins in a leaf, giving plenty



of surface area to dissipate heat. Thanks to the low heat output neither of these heatsinks got very hot in use.

Four DDR2 slots give dual-channel capability, while the 8-pin and 24-pin power connectors are placed in the usual spots. There's four right-angled SATA ports and an additional vertical SATA port adjacent, but no IDE connector. Oddly the extra SATA port appears as eSATA in the BIOS, which might confuse those who expect it to actually be external! The tiny heatsink cooling the SB750 southbridge does a decent job, surrounded by front panel and USB headers. Front panel audio header sits at the bottom of the mobo. Expansion slots cover two PCIe 1x, a single PCIe 16x and a PCI slot. This should be more than enough for what most people are after, but it also means that Crossfire is a definite impossibility.

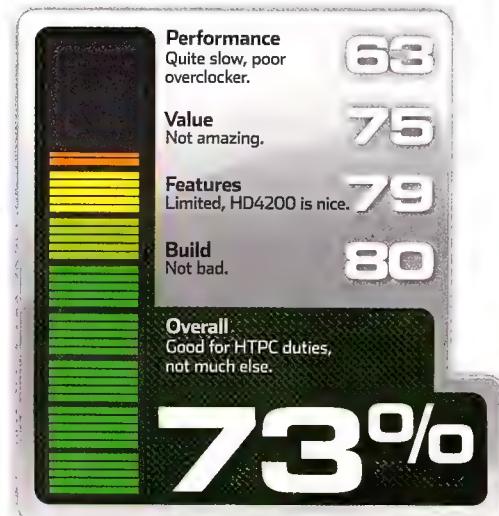
Buying back into the old mentality that mATX boards are poor overclockers, we only managed to push the Cinema II to a maximum speed of

233x16 for an effective final speed of 3728MHz. Considering most boards will overclock at least over 240MHz this is a pretty bad result, and even the performance of the Phenom II X4 955 chip was hindered by the limited bandwidth available in the DDR2.

This basically leaves this board sitting in a funny place; it's not a great overclocker, it doesn't have exceptional performance at stock and it doesn't have a huge array of expansion options. It might be a nice choice if you're looking to upgrade an older AMD system to the newer chipset or if you want to repurpose old tech for a media rig, but if you're looking to build a new rig you'd be pretty mad not to jump over to Intel's offerings – they're simply a better choice from a pure price/performance standpoint.  JR

Foxconn Cinema II Deluxe

	X4955 7-7-7-21	200x13; DDR3-1333 7-7-7-21	217x13; DDR3-1446 7-7-7-21	230x13; DDR3-1532 7-7-7-21
PiFast	34.93s	32.79s	30.73s	
wPrime 32M – single thread	44.708s	41.277s	38.891s	
wPrime 32M – multi-thread	11.778s (3.62x efficiency)	11.076s (3.81x)	10.234s (3.77x)	
CineBench R10 64-bit – single thread	3679	3989	4266	
CineBench R10 64-bit – multi-thread	13330 (3.62x efficiency)	14437 (3.62x)	14900 (3.49x)	
Everest Read	7336MB/s	7770MB/s	8231MB/s	
Everest Write	6739MB/s	7319MB/s	7752MB/s	
Everest Latency	56.8ns	57.2ns	54.3ns	



MSI P55-GD65

Stepping up to the plate.

Street Price \$240 Supplier MSI

Website www.msicomputer.com.au

Specifications Socket LGA1156; Intel P55 chipset; ATX form factor; 2x PCIe x16; 1x PCIe x4; 2x PCI; 2x PCIe x1; 1x EIDE; 7x SATA; DDR3-1600

Gallery www.atomicmpc.com.au/?152203

When Lynnfield, P55 Express and the LGA1156 socket launched last month, MSI's BIOS wasn't ready for enthusiast overclocking – but its devs have taken to the BIOS with aplomb and finesse, eking out an update for MSI's midrange board that seeks to fix the problems we had last time around. The good news is that they've achieved just that, with only a few minor niggles along the way.

Physically this mobo is very similar to the earlier P55-GD80; the only real visible difference being the lack of a heatsink for the Packet Switch chips in the middle of the board (that run so cool they don't even need one) and a single PCIe 16x slot being dropped. Even with some of the cooling missing however, the heatsinks on the power regulation around the LGA1156 socket handled the heat load admirably and barely became noticeably warm. There's also plenty of room for big heatsinks, being surprisingly roomy compared to the highest-end P55 motherboards out there.

The rear I/O panel provides two PS/2, Optical/Coaxial, 6-pin Firewire, seven USB, a hybrid USB/eSATA, two Ethernet and 7.1 channel audio. It's powered by a Realtek ALC889 audio chip, the current standard in audio, which does a decent job. Adjacent to the CPU socket are four DDR3 slots for memory up to 2133MHz via overclocking, spaced far enough away from the socket to allow taller memory heatsinks.

Along the right edge of the motherboard lies the 24-pin power connector and a floppy port, above which is a series of voltage measurement holes. These are very handy for overclockers to check actual voltages of the tech, and it



measures six key areas on the mobo for realtime readings with a voltmeter. A right-angled IDE socket sits next to six right-angled SATA ports, with a single vertical SATA port resting just behind. Front panel headers and USB headers lie at the bottom right corner of the board in the usual place, with a small heatsink nearby cooling the P55 Express chipset. While it isn't cooled by immense amounts of material, the chipset remained perfectly fine under load at stock but some airflow was needed to keep temps stable when overclocked.

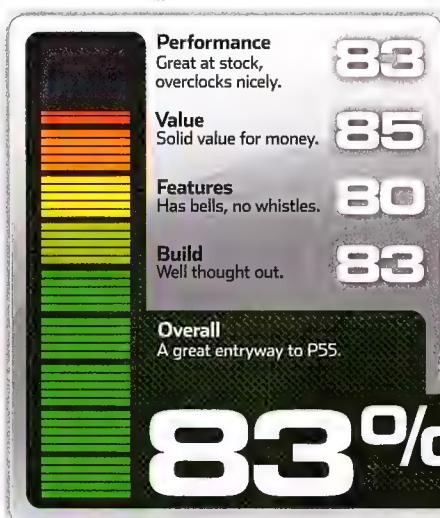
The bottom edge of the mobo is dotted with hard buttons, covering Power and BCLK controls for the system and CPU respectively. Also here is MSI's OC Genie button; a press before booting will have the system auto-overclock the chip to a decent overclock, but as always a manual BIOS overclock is always the best option. There is sadly no clear CMOS button to be found anywhere on the board, but the recovery was pretty good when overly ambitious settings refused to boot, giving us easy access to the BIOS.

Updating this mobo to the latest version of the BIOS unlocked a heap of reliability and speed that the P55-GD80 hadn't showed last Issue, overtaking the ASUS P7P55D Deluxe for sheer speed at stock and remaining competitive until the second OC level. The reason for this was a strange refusal to overclock with Turbo Mode and EIST enabled in the BIOS at any speed over 3.5GHz. Once Turbo and SpeedStep had been disabled this allowed the chip to be raised to a final max speed of 187 x 22 for an effective speed of 4.1GHz, a very nice showing. vDroop proved to be a small hindrance here, dropping almost 0.1v under load, but once there it was quite stable.

This mobo slots in at \$240, just slightly more expensive than the GIGABYTE P55-UD4. If you're going to be overclocking we'd tell you to get the latter, but if you're not one for tweaking this is hands-down the best choice for stock performance.  JR

MSI P55-GD65

	17870 133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
PIFast	25.19s	22.12s	22.87s
wPrime 32M – single thread	36.521s	32.43s	33.68s
wPrime 32M – multi-thread	7.786s (4.69x efficiency)	6.91s (4.69x)	6.442s (5.23x)
CineBench R10 64-bit – single thread	4554	5170	5408
CineBench R10 64-bit – multi-thread	17780 (3.90x efficiency)	20533 (3.97x)	21939 (4.06x)
Everest Read	17347MB/s	18123MB/s	15509MB/s
Everest Write	10889MB/s	15853MB/s	14174MB/s
Everest Latency	47.0ns	44.1ns	46.3ns



ATI 5870

Red-hot performance.



Street Price \$550 Supplier ATI
Website www.ati.amd.com

Specifications 850MHz core; 1200MHz memory (4800 effective); RV870 core; 1600 shader units; 1024MB GDDR5; 256-bit memory interface; dual slot PCB with active cooling; dual 6-pin PCIe power connector

Card Info www.techpowerup.com/gpuz/3csus

Fourteen months ago was a tumultuous time in the graphics arena, with both NVIDIA and ATI releasing what would become the cards we've now used for over a year. The time has come once again for the latest in graphics card releases, bringing around a whole host of musings and speculation about specifications, speeds and features. What is arguably the most important component in any gaming system has been redefined, and so enters the new challenger. Bring on the 5870.

A better mousetrap

When ATI released its 4870 graphics card it came into the game bringing about a host of changes; GDDR5, 55nm manufacturing and a price point that now sees you spending only \$200 for a well-performing card. It shook the gaming community, and its pricing was enough to send NVIDIA quaking in its green boots, responding with massive price cuts and running on the razor-thin edge of profits for fourteen long months.

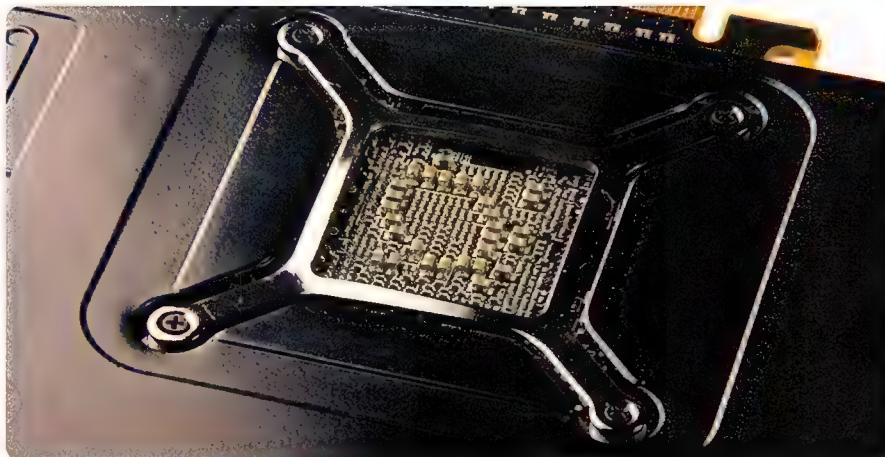
No-one expected ATI to manage to top its own incredible launch by a significant margin, but that's exactly what the company's done. The successor comes in the form of the 5870, a card manufactured completely on a 40nm manufacturing process – this is more technologically advanced than the best CPUs Intel or AMD currently manufacture – and this process is repeated throughout the entire 5-series lineup. This newly-shrunk core is based off the original 4870's RV770 design, and while it shares many things with its predecessor there



are a lot of new features packed in, as well as a huge leap in processing performance.

The RV870 manages to effectively double the shader units inside the graphics core, squeeze out higher performance from the 1GB of GDDR5 memory on the same 256-bit memory bus and manage to power through benchmarks like never before. It's got a doubling in pretty much every specification, but the most astounding of all is the transistor count – going from the 956 million of the RV770 to a phenomenal 2.15 billion transistors in the RV870. Each individual transistor is smaller than a human hair's diameter, and they compare in size to that of your average strand of DNA. In fact they're so small that you couldn't hope to see an individual transistor by itself without the aid of an incredibly powerful microscope, and they're so precisely manufactured that if only a few of them malfunctioned entire areas of the core would become faulty.

What do all these transistors add up to, and why should you care? Well, because all the changes add up to a card faster than anything previously released in the history of computing.



Boosting brainpower

The original RV770 core took up 263mm², and ran 800 shader units inside a very small area. As the easiest way to boost performance is to simply increase the processing units inside a core, that's the step that ATI's engineers took – but instead of merely adding in a few more they completely doubled the amount available to a whopping 1600 shader units at a size of only 334mm². These are organised very differently to NVIDIA's cards, and rather than being a homogenous collection of identical units they are organised into regimental blocks.

Twenty heterogeneous areas in the core, called SIMD Engines, are where the main processing occurs. Inside each SIMD Engine is a series of sixteen Thread Processors, and inside each of those are five Stream Cores. What this all adds up to is a 'hive' of small units that work together and add up to a total of 1600 mini-processors, also granting a huge 320 possible threads that can be worked upon. Forget hyperthreading, this is megathreading on a grander scale than any CPU can muster.

The five Stream Cores kept within a Thread Processor are also unique, and while four of them are identical to each other and work through stuff as normal, the fifth Core is used for special functions exclusively. These functions can be anything from physics calculations, artificial intelligence or even simply used to boost performance in demanding areas that aren't always linked to what is visually displayed. All of these Stream Cores have access to a built-in Branch Unit that works identically to the Intel counterpart, quite literally predicting the branches that a particular string of code might take and pre-caching those instructions in memory to speed up access. This might mean that some information is cached needlessly, but if the information is used it saves a significant amount of fetching time.

Backing up all these processors are four Texture Units per SIMD, for a total of 80 units, which play an essential role in working with the textures stored in the card's memory; wrapping the data around the XYZ axis in the game world

and placing the textures against the models that give us the coloured objects that we see. Having so many of them – again a doubling of the RV770's armament – simply means that texturing will be able to be performed at a blistering rate. Due to the nature of their work, each Texture Unit has access to 8kB of paint-strippingly fast L1 cache running at 1TB/s.

As the L1 cache would run out of space quickly without any support, there are four chunks of L2 cache that are linked to the L1 cache through a connection called Crossbar. The Crossbar provides a huge bandwidth of 435GB/s, and each L2 cache holds 128kB – more than enough information for a decently-sized buffer. So far each SIMD Engine is kept running by the units running within it, and in turn they are fed by the L1/2 caches, but it's when the 1024MB of GDDR5 comes into play that things become interesting.

Constructed with the same ring topology as the RV770, there have been a huge amount of modifications and tweaks applied to the RV870's GDDR5 controller to allow more performance from the same resources. Located at the outer edges of the core, to ease access to memory, an Error Detection Code (EDC) unit has been installed in the system to improve the reliability of the data transmitted. This allowed ATI's engineers to pump up the clockspeed of the memory from 900MHz to 1200MHz, which equates to an effective quad-pumped speed of 4800MHz. An astoundingly huge bandwidth is available to the RV870's memory, delivering 153GB/s to the L2 cache as well as the rest of the system. This is in some ways the most important piece of the entire puzzle, as without enough data to work with the 1600 processors in the core would quickly devour the workload and effectively be starved of work while waiting for more data to be delivered.

Many other specialised units inside the core that are worthy of mention include the AA Resolve, doubled to a total of 128 units that take over the AntiAliasing duties completely and smoothen harsh edges, known as 'jaggies'. There are Z/Stencil units, which are essentially Z-buffer processors, that work to tell the card

how far away an object is in the virtual world. The further away the object, the less rendering work the Stream Cores have to do, creating better performance. Essentially the entire working process of the main components can be summarised thusly:

GDDR5 > L2 Cache > L1 Cache > SIMD Engine > Thread Processor > Stream Cores > Output

game an outline and some substance.

Where DirectX 11 differs from the preceding versions is the implementation of a Tessellator that happens at the same time as both the Geometry and Vertex Assemblers. While it only happens with DX11 code, the Tessellator is a special hardware feature that takes the product of both other Assemblers and multiplies it with a series of calculations – adding in extra polygons that

It all starts with the Command Processor, essentially similar to the traffic control tower at any international airport.

Graphics engine

Knowing the hardware running inside the RV870 core is helpful, but the real-world applications of the tech in there is perhaps even more useful. It works much the same way as the RV770, but there are quite a few notable changes that are brought around by the big daddy in the programming world, DirectX 11. While the 5870 is still compatible with all the DirectX versions from 1-10, there is a much-defined process that manages the software's interaction with this beefy hardware.

It all starts in the Command Processor, essentially similar to the traffic control tower at any international airport. Instructions are relayed to the Command Processor by the graphics drivers running in the operating system, and the required actions performed depending on which specific tasks need to be delivered. Focusing on just the most basic task, creating a single frame for a video game to be displayed on a screen, it all starts in the Geometry stage.

Modelling data is sent from the GDDR5 through the Crossbar, hitting the SIMD Engines, which are told by the Command Processor to work upon the Geometry Assembler stage. This isn't a physical unit, and instead is simply executed by the multipurpose Cores within the SIMD Engine. The Vertex Assembler stage is executed at the same time as the Geometry Assembler, each process giving the objects in-

weren't coded by the programmers, and giving a huge amount of extra detail to the models.

The 80 Texture Units kick in after the models are complete, adding in the colour that brings life to the game world and blocking the wireframe models from view. Since all this information up until this stage isn't anything but simple ones and zeroes kept in a cache, it's not exactly something that you'd look at and much less something you'd play. This is where Rasterizer units kick in, looking at the digital information and translating it into a static – and most importantly flat – image that can be sent out to the next and final stage of the process.

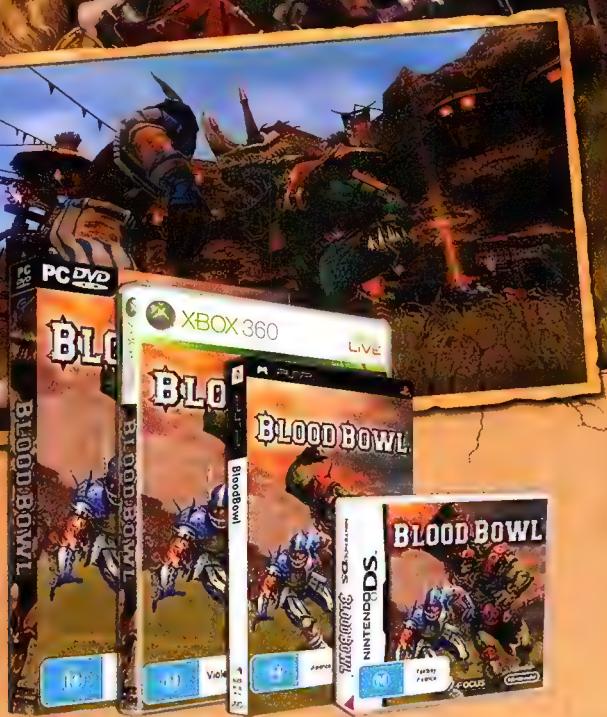
This stage is the Hierarchical Z that decides exactly which parts of the gameworld the user should be able to see, removing those pieces that shouldn't be visible. The final image should hopefully (if everything worked correctly) be at the resolution of the game settings, and sent to the monitor. This is a process that happens tens of times every single second; to hit the 60fps needed to match a screen refresh rate of 60Hz this means in a single minute this entire process will be run through 3600 times! Summarised, it looks like this:

Command Processor > Geometry Assembler > Vertex Assembler [DX11 Tessellation] > Texture Units > Rasterizer > Hierarchical Z > Output



BLOOD BOWL

-THE VIDEO GAME-



Blood Bowl is now a video game!

Blood Bowl - the famous Games Workshop board game - is now a video game! As a combination of a tactical strategy game and a sports game, Blood Bowl is first of all a great violent game where the ends justify the means to lead your team to the Blood Bowl finals. In order to reach this goal, you'll have to build and manage your team through many championships and tournaments.

PC, NDS & PSP versions Coming October, Xbox 360 coming in November



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Power-filled hardware

High-end graphics cards, especially when running all the features outlined already, are typically giant energy guzzlers that pump out more heat than a gas stove. This card is somewhat unique, and comes with a bunch of methods that aim to keep everything cool when needed. Considering that it is double what the 4870 was, the logical thinking would also be a doubling in power consumption – but rather than going from 160W to 320W, the 5870 has actually managed to keep it to a cool 188W. Even more impressive than load power consumption is idle consumption, dropping to a barely-noticeable 27W!

This was echoed in temperature results, the stock cooler returning an idle temperature of only 42 degrees Celsius. Load was a little warmer at 66 degrees, but considering that other cards regularly hit the high eighties this is very good. At idle it also manages to drop the fanspeed significantly to make a whisper-quiet 50.9dBA, but load is pretty noticeable at a loud 62.6dBA. This is forgivable – you can have a

silent PC for movies, and when you're gaming you'll be under headphones!

The stock cooler itself is a pretty bold statement that echoes ATI's recent aggressive improvements, shaped like an elongated Batmobile with rough grills and flares added all over. A single bright red racing strip runs the length of the card at the top, and a squirrel-cage fan takes in air to exhaust most heat out the back of the case, though some was exhausted near the two Crossfire pins to enter the case. Power needs are filled by two 6-pin PCIe connectors, and display options are the best we've seen on a card. They cover two DVI, HDMI and a DisplayPort connector, and three of these outputs can be used at any one time to give compatibility with AMD's Eyefinity tech. Crossfire is a definite possibility, though only within the 5xxx series family.

Earth-shattering performance

It's not uncommon that a card will fail to impress us with lacklustre performance or simple

mediocrity – so imagine our shock when we got stuck into this card and found it took every single benchmark result, kicked it in the balls, set it on fire, then punched it hard enough for a facial implosion. Comparing the 5870 to the 4870 reveals the hardware boost's actual improvements – *Crysis* returns average frames per second increases of 28.43 (up from 55.51), *GRID* average increase of 32.641 (up from 99.267), *3DMark06* increase of a whopping 5007 points (up from 16811) and a *3DMark Vantage* increase of 6412 (up from P10599).

So powerful is the 5870's single RV870 core it can even trounce what was the worldwide fastest card – the ASUS GTX295 Mars. Again *Crysis* returns average frames per second increases of 12.08 (up from 71.86), *GRID* average decrease of 0.48 (down from 132.388) and a *3DMark06* increase of a whopping 2518 points (up from 19300). Sure *GRID* doesn't increase at all, but considering the GTX295 Mars is running **two** of NVIDIA's fastest cores it means that the 5870 is placed firmly in the winner's seat.

Performance is good enough with a single 5870 to run the demanding *Crysis* at 1920 x 1200 with 2xAA at Ultra High, and return a solid 30fps. This means that any game you throw at this card for the foreseeable future in the PC world will be chewed up and spit back at a huge pace – one that is faster than ever before.

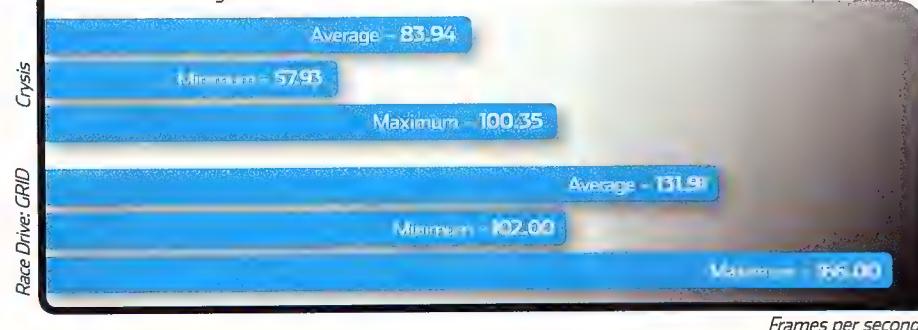
Verdict: 5870... win

With a rumoured price point of US\$399, when the 5870 hits Aussie shores we can expect it to come in at just over \$550, and definitely less than \$600. It's going to have two models either side, the 5850 slotting in below, with less performance, and the 5870X2 above it with two cores – essentially two 5870s on a single PCB. What this means is that performance better than the GTX295 at \$730 can be had for a price coming in a few hundred dollars less! I've never found myself swung by marketing speak before, but in the words of ATI themselves – "the game has changed". The game is red.  JR

ATI 5870 3d Mark scores



ATI 5870 Gaming Benchmarks



XFX 5870

The first retail 5-series card!

Street Price \$618 Supplier XFX

Website www.xfxforce.com

Specifications 850MHz core; 1200MHz memory (4800 effective); RV870 core; 1600 shader units; 1024MB GDDR5; 256-bit memory interface; dual slot PCB with active cooling; dual 6-pin PCIe power connector

Card Info www.techpowerup.com/gpuz/h6y67



The 5870 launch is exciting enough to make any serious gamer wet themselves with upgrader's glee, and touts improvements tangible enough to provide actual motivation and reason to get out there and finally move to high-end graphics. While this card isn't the highest-end card in AMD/ATI's lineup, it's the smartest choice for a lot of gamers for plenty of reasons, the first being a price reachable for most people on a budget. Swinging in at \$618 this card might seem a bit pricey on the surface, but included in the box is a Steam download voucher for DIRT 2 – the first DirectX11 game to hit the market – and it's not even out until early December!

Pulling the card out of the box reveals the standard reference cooler, but this has been coated in a full-length XFX sticker. Adorned in its new coat of livery, the card looks much more impressive than other offerings, though the top retains the same etched logo as any other card. Four digital outputs give support for two DVI, one HDMI and one DisplayPort connector, with up to three of them usable at any one time. There are two Crossfire nipples on the top of the card that can whack up to three of these babies together (or any other card sporting the same RV870 core), and power needs are filled by two 6-pin PCIe power connectors. It won't start up at all without both cables connected, and will wail louder than a disgruntled banshee if it doesn't have enough juice.

Nestled underneath that black plastic shell is the cooling, provided via a simple copper heatsink/heatpipe combo and aluminium fins. A large squirrel-cage fan sucks in cool air at the end of the card, pulling it along the length of the card and exhausting some of it out the back of the case, though most of it spills upwards past the Crossfire nipples and enters the case. This is quite a large card, being significantly longer than even the 4890 was, and overhanging a standard ATX motherboard slightly.

Idle temperatures are pretty awesome at only 43 degrees Celsius with 50.0dBA, thanks to the core and memory clocks dropping themselves massively when not in use. This increased to an annoying 63.6dBA and 69 degrees load, but it's forgivable and most of all ignorable under the noise of a game.

Running deep down in the centre of this card is the newly redesigned RV870 core, sporting a whopping 1600 shader units and a 256-bit memory bus powering 1GB of GDDR5 memory.

In terms of sheer memory bandwidth we're talking 153.6GB/s, trouncing even Nehalem's DDR3 memory controller by almost five times! It's all built around a 40nm manufacturing process that keeps the size manageable, and the die only measures 334mm² – incredible considering the 2.15 billion transistors used.

Performance is quite honestly one of the biggest leaps since the 8800GTX years ago, chewing through the previous generation's top-end cards and redefining the performance playground and dragging everything else comparably downwards. Every benchmark, be it 3DMark06 or Crysis, benefitted from this increased speed, with enough raw power to play the latter on Ultra High at 1920 x 1200 no AA and get a decent 30fps. While the much-touted photorealistic game isn't going to be around for quite some time (processing power still isn't high enough for that), it's a huge leap in the right direction.

Being first off the rank with a great bundle gives XFX some kudos, and if you splurge on this card now you'll have a card more powerful than anything you could've dreamed of two years ago.  JR

XFX 5870 3d Mark scores



Performance
Incredibly solid performance.

93

Bundle
Can anyone say DX11?

90

Value
A bit pricey, but it'll come down.

84

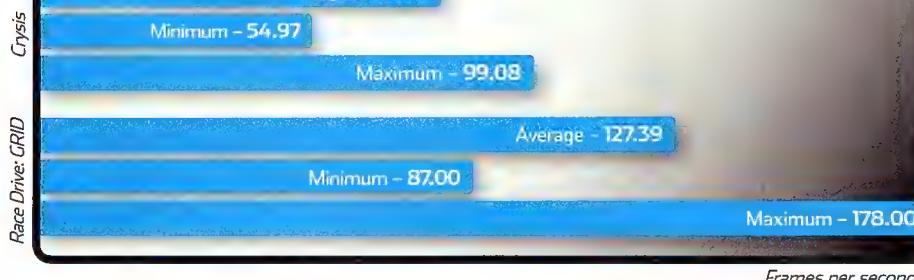
Build
A little loud.

86

Overall
Quite pricey, but worth it.

89%

XFX 5870 Gaming Benchmarks



MSI N275GTX Lightning

.sdrawkcab demaN

Street Price RRP\$539 **Supplier** MSI
Website www.msicomputer.com.au

Specifications 700MHz core; 1150MHz memory (2300 effective); GT200 core; 240 stream processors; 1792MB GDDR3; 448-bit memory interface; dual slot PCB with active cooling; dual 6-pin PCIe power connectors

Card info www.techpowerup.com/gpuz/wczsg

MSI has never been known for its comprehensible naming schemes, and while its motherboards have been reworked to make some kind of sense now (compared to MSI's previous 'Diamond' and other odd names), the graphics cards are still in limbo. The performance should still be comparable with those traditionally named cards, but certainly won't help it be found online.

Based on the GT200 core with 240 stream processors, the N275GTX runs at an increased factory speed of 700MHz (a 77MHz bump) and a memory speed of 1150MHz (a paltry 16MHz rise). Coupled with twice the reference memory at 1792MB of GDDR3 on a 448-bit memory bus this card has plenty of space and bandwidth for texture modding. When overclocked it reached 752MHz on the core (a seven per cent increase), but strangely the memory speeds seemed to be able to increase indefinitely – hitting an almost incomprehensible 29 per cent increase at a 1478MHz speed. This effectively granted a speed of 2956MHz double-pumped, but it came at a huge performance cost – the card clocked itself down to return a crippled 10171 in 3DMark06. If you're going to overclock, stick with just a small increase and watch for the point where more clockspeed actually reduces performance.

Odd overclocking aside the stock gaming performance was quite adequate but not outstanding, providing a playable Crysis and



a silky smooth GRID. There were a few odd stutters in GRID, but this seemed driver related and cleared up after a reinstall. 3DMark06 and Vantage both show respectable scores, though these were actually lower than the standard GTX275 Twin Frozr (www.atomicmpc.com.au/?154460) in some cases, even though the Lightning is clocked faster.

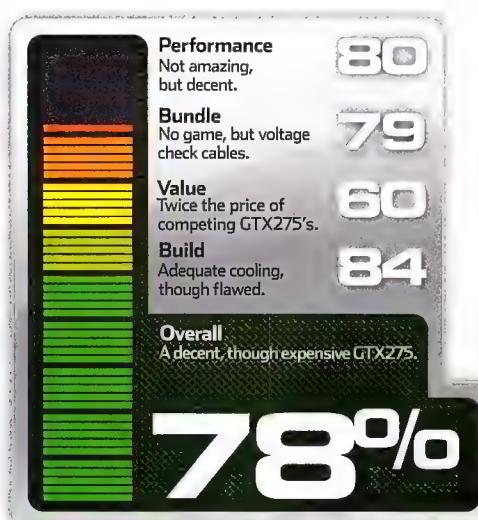
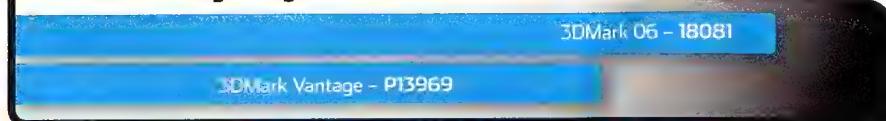
The Lightning comes with small cables that connect to two headers near the twin PCIe 6-pin connectors, which allow direct voltage measurement. This might prove handy for overclocking.

Cooling is taken care of by MSI's Twin Frozr II, a heatsink that has seen extensive use across all the recent graphics card releases. Five nickel-plated heatpipes meet at a large base

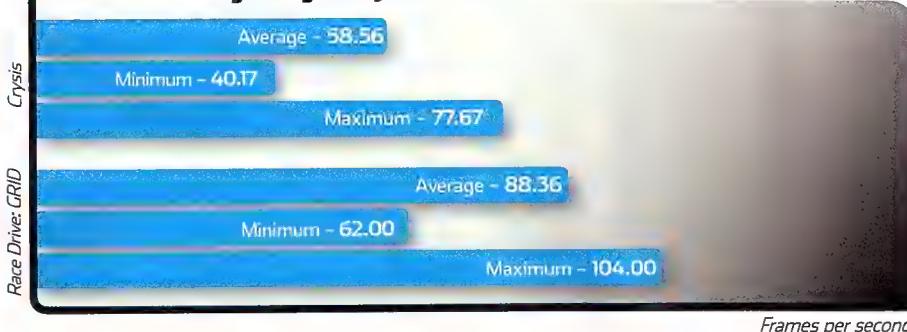
that mounts onto the GT200 core, sucking away the thermal energy and taking it to a series of aluminium fins. Each heatpipe is spaced equidistantly, which should mean that the heat is spread around nicely, but we found that it concentrated most at the top half of the heatsink. Two dinky fans take care of airflow needs but these don't appear to be powerful enough to push air through the fins, leaving the PCB and memory underneath quite hot under stress. It looks the part on the black PCB however, and should look pretty neat inside a case. Idle temperatures sat at an adequate 51 degrees Celsius with an average noise of 51.4dBa, hitting 64 degrees and 51.2dBa under load.

At the back of this card lies HDMI, DVI and VGA outputs, a strange choice but useful for those with unique compatibility needs. There's a vent on the expansion bracket proper, but hardly any of the heat will actually be exhausted through it – if indeed you can feel the airflow from this card at all. Definitely worth pondering. 

MSI N275GTX Lightning 3d Mark scores



MSI N275GTX Lightning Gaming Benchmarks



GIGABYTE GTX260 Super Overclock

Cherry picked goodness.

Street Price RRP\$299 Supplier GIGABYTE
Website www.gigabyte.com.au

Specifications 680MHz core; 1250MHz memory (2500MHz effective); 1499MHz shader clock; GT200 core; 216 stream processors; 896MB GDDR3; 448-bit memory interface; dual slot PCB with active cooling; dual 6-pin PCIe power connector

Card Info www.techpowerup.com/gpuz/nyaaq

Graphics cards are usually the first port of call when a gamer wants to beef up their system, and as you probably already know they're not all made equal. GIGABYTE has seen to that issue though, running all the GT200 cores the company got through a binning process to cherry-pick the very best cores for use in its Super Overclock series of cards. This is an impressive amount of effort.

Based around the GT200 core with 216 stream processors, this card runs at a stock clockspeed of 680MHz – that's 104MHz over the reference clock! Also beefed up is the 896MB of GDDR3 on a 448-bit memory bus, which runs at a heightened 1250MHz, compared to the reference of 999MHz. GIGABYTE's not only chosen exceptional cores, but also paired them with Hynix memory chips to ensure great bandwidth speeds.

All this increasing of clockspeeds gives an immediate benefit in game performance, besting

Cop that!

As with its mobos, GIGABYTE has built this card with dual two-ounce copper sheets in the PCB. This should distribute heat better, and provide clearer electrical signals, all adding to the overclockability. You can even see the thicker layers of copper when looking at the PCB side-on – neat!



MSI's GTX260 Lightning (Issue 104, page 37) performance by 1fps Crysis average, 2fps in GRID average and also winning in both the max fps scores. This is echoed in the 3DMark benchmarks, but unfortunately this increase is so small it's not even particularly worth mentioning – the leap to a GTX275 isn't much extra but gives a relatively large increase in performance.

Even though it doesn't add a huge amount of extra performance, when overclocked we hit a maximum core speed of 737MHz (plus eight per cent) and a memory speed of 1316 (plus five per cent). This equates to a core increase of 161MHz over reference – a 28 per cent total increase.

While the overclocking prowess is impressive the cooling used is disappointingly average. It's a simple reference cooler, essentially a large black shell with a GIGABYTE sticker on it that channels airflow past an internal heatsink. A squirrel-cage fan sucks in air from the case at one end, pushing it past a series of aluminium fins and

exhausting out the rear of the case. There's a meaty copper base that contacts the core, and three large heatpipes that move the heat around effectively. It's a dual-slot design, but we can't help but think that larger overclocks could be granted with better cooling.

It ran at an idle temp of 54 degrees with 56.4dBA, and hit a load of 74 degrees with only 57.2dBA. This is actually a 'feature' listed on the box – where the fan will only kick in once the core temperature has reached an uncomfortably-warm 85+ degrees. Sure it'll mean that the card doesn't get annoying, and true it didn't actually get that hot even when overclocked, but since we tested in the open-air testbed it could be worse in a cramped case.

The display options are a bit odd with HDMI, VGA and DVI – DisplayPort is strangely excluded, but at least you'll have most options available from the card directly. There is no game included.

Coming in at an RRP of \$299 means that this will be a luxury card, but considering that the GTX275 cards go for \$290 you'll have to decide if the small savings is worth it for awesome overclockability.  JR

GIGABYTE GTX260 Super Overclock 3d Mark scores



GIGABYTE GTX260 Super Overclock Gaming Benchmarks



Performance
161MHz overclock is very impressive.

84

Bundle
Cables, but not much.

70

Value
It's okay, not astounding.

78

Build
Runs hot, but well built.

75

Overall
A great choice for overclockers, but get aftermarket cooling.

80%

ASUS Mars

Performance that is out of this world.

Street Price RRP\$1999 (!!!) Supplier ASUS
Website www.asus.com.au

Specifications 648MHz core; 1152MHz memory (2304MHz effective); 1476MHz shader clock; GT200 core; 240x2 stream processors; 4096MB GDDR3; 512-bit memory interface; triple slot PCB with active cooling; dual 8-pin PCIe power connector

Card info www.techpowerup.com/gpuz/6858v

NVIDIA first brought out its massively monolithic GT200 core over a year ago, debuting with the GTX280 at 65nm, being shrunk and clocked faster with the GTX285 at 55nm, and finally with two cut-down GT200 cores slapped together with a slower clockspeed and memory bus to form the GTX295 – essentially two GTX260s. The current ruler of the performance roost, the GTX295 is only seriously challenged by ATI's 4870X2 – but now ASUS has made its own card that trumps them all – but not the 5870.

Named the ASUS Mars, that cheekily hints at that otherworldly design, this card is based on two GT200 cores from the GTX285 – meaning that the full complement of 240 stream processors at a heightened 648MHz core speed is included. Couple that with a mind-warpingly insane 2GB of GDDR3 memory on a huge 512-bit memory bus *per card* this adds up to a total of 4GB of memory space. In other words, more memory on a single card than most people have in their entire system!

Naturally with this boosted performance and ensuing TDP increase comes the need for a beefed-up cooling system, so the two PCBs are both attached to a central heatsink that is packed with heatpipes and aluminium fins. Each core has a solid copper block to suck away heat, and the memory chips are all nestled



deep within and are cooled by the array. One powerful squirrel-cage fan whirs away at the end of the card to blow hot air mostly out the rear of the case, but a lot of it simply exhausts out the top into the system. Entirely encased in a silvery metallic casing, it's got ASUS logos and the limited edition stamp showing off which card out of 1000 it is. A black PCB and more brushed steel ASUS logos put every other card to visual shame, but the weight is close to 2kg. Idle temps are a crazy 71 degrees Celsius at a noisy 62.2dBA, increasing to 85 degrees load at 73.9dBA – incredibly toasty at all times, and noticeably loud to boot.

Of course with a limited run of these cards they're not exactly meant for anyone but the most avid ASUS/NVIDIA fanboi, but if you're after blistering technical specs you get pretty much what you pay the mind-boggling \$1,999 for. Performance is a strange one however; compared to an XFX GTX295 it runs slightly

slower in Crysis and 3DMark06, but powers past it in GRID and 3DMarkVantage. The reason behind this is quite clear – at the lower 1280 x 1024 resolutions of the former tests this card is not being stressed enough for a difference to be clear. At the heightened 1920 x 1200 GRID res it pulls ahead, and in Vantage's stressy GPU tests it shows its worth.

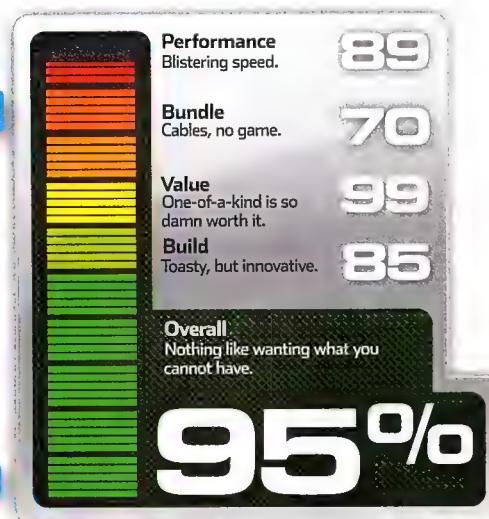
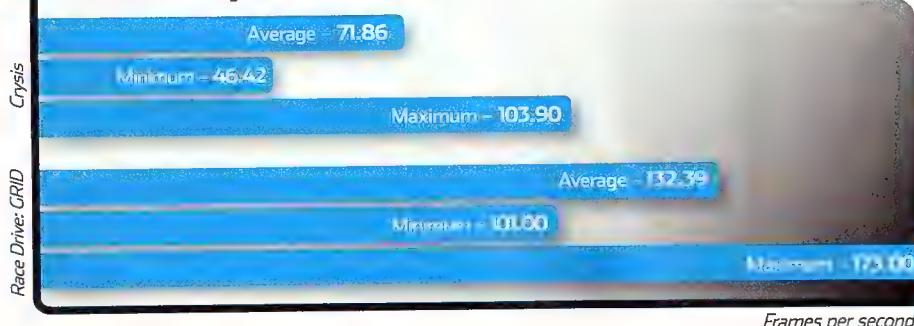
If you've got the cash to drop on such a luxury card, odds are you've got a 30in LCD, full surround sound system and a gold-plated toilet seat, so this card will be perfect for any intensive GPU use. Sure you can't really buy one if you wanted to, but innovation in any form is a great thing for the market and if ASUS can flex its mighty engineering arms it might spur other manufacturers into competition. The more competition there is the better value we get!

Deciding how this card compares is a tricky task, but if the gaming performance and tech specs suggest anything it's that the Mars will run absolutely any task thrown at it for the next couple of years without feeling slow – though it is now surpassed by the single-cored 5870 on page 42. While it is toasty warm, it's a one-of-a-kind-wonder.  JR

ASUS Mars 3d Mark scores



ASUS Mars Gaming Benchmarks



Galaxy 9600GT Low Power

Small in stature, but a little too punchy for its own good.

Street Price \$129 Supplier Galaxy
Website www.galaxytech.com

Specifications 600MHz core; 900MHz memory (1800MHz effective); 1500MHz shader; g94 core; 64 stream processors; 512MB GDDR3; 256-bit memory interface; half height PCB with active cooling

Card Info www.techpowerup.com/gpuz/2fh4r

For a while, the 9600GT reigned supreme as the best choice for any gamer looking for a graphics card on a budget. Offering solid performance it only needed a single 6-pin PCIe power connector, which most PSUs had well and truly covered, without emptying the wallet too much. Now some months later, the 9600GT is being resurrected by Galaxy – but it's a different beast entirely.

It'd probably be closest to being a beast-ette, as the 9600GT Low Power takes up a half-height form factor. Packed into this smaller size is everything that the original card had; with a G94 core running 64 stream processors, 512MB of GDDR3 memory on a 256-bit memory bus and a core speed of 600MHz. The core is manufactured on a 65nm process, which is one generation old in GPU terms and shortly to be two steps behind when manufacturers hit 40nm across the new wave of cards.

Physically this card is impressive, though still quite small. It takes up half the height of a standard single-slot card, and is cooled by a small copper heatsink with copper fins. There's a plastic shroud around the whole apparatus, covered with a white tiger sticker, and cooled by a single teensy fan. These fans are usually quite loud and this one is no exception, running at a constant 73.3dBA whether idling or under load. This is due to the fan being run at 65 per cent speed, which is disappointing considering the



3-pin fan cable allows direct control via software, making it pretty quiet for not much more heat. Considering this form factor is intended mainly for HTPC setups it's inexcusably loud, so unless you use your PC with ear plugs you'll need to play with the fan settings.

Thanks to the Low Power moniker attached to this card, it draws power exclusively from the PCIe bus and doesn't need any external power. Handy for those forgetful builders out there, and the space saved is just enough to squeeze everything into the small form factor. Strangely it seems that the PCB is coloured in a blue that is very similar to the traditional GIGABYTE blue, and at first glance you'd be forgiven for getting it wrong. PCIe 2.0 means that the card has plenty of bandwidth, though this is probably over the top for this card (especially considering the 240 stream processors of the GTX285).

Performance in games was pretty poor

compared to the current high-end cards, but turning a few settings down will give smoother frames per second and give a pretty playable experience. The 512MB of memory might prove to be limiting if game mods are applied, but shouldn't prove a problem in most cases. 3DMark performance in both benchmarks was predictably limited, but there's enough grunt in this card to run most games out there. HD video and Bluray playback is a definite plus for this card, though again the fan noise will interfere with comfortable watching. Both the HDMI and DVI video outputs are HDCP capable, and a simple SPDIF cable can embed the audio into the HDMI output from the motherboard.

Temperatures at idle were a decent 54 degrees Celsius, but under load this soared to 72 degrees. While overclocked to 724MHz core (plus 21 per cent) this was even hotter, but still quite stable. Memory only clocked two per cent higher to 920MHz. There's no bundle to speak of save for a few cables, driver CD and manual, leaving this card in an odd spot.

We wouldn't really recommend it for a gaming rig, since the 4770 is a much better option. 

Galaxy 9600GT Low Power 3d Mark scores

3DMark 06 – 11331

3DMark Vantage – P4991

Score

Galaxy 9600GT Low Power Gaming Benchmarks

Average – 27.72

Minimum – 18.77

Maximum – 30.41

Average – 26.48

Minimum – 16.00

Maximum – 34.00

Race Drive: GRID

Frames per second

Performance
Starting to show its age, but nice overclock.

66

Bundle
Nothing to sweeten the deal.

70

Value
Not bad for a half-height card.

30

Build
Loud and hot.

59

Overall
The drawbacks mostly outweigh the advantages.

66%

SilverStone Strider 1500W



Makes excessive look modest.

Street Price \$366 Supplier Altech
Website www.altech.com.au

Specifications ATX form factor; 24-pin, 8-pin ATX, 12x molex, 12x SATA, 4x Floppy, 4x 8/6-pin PCIe, 4x 6-pin PCIe.

Sometimes you hear a calling from a certain piece of tech, demanding that you buy it and install it in your system. When the next piece calls, you simply add it to the pile, adding more and more until you're draining an entire city block's worth of power just to feed your technomania. This is the powersupply for such technomaniacs.

Boasting eight 12V rails at 25A each, this is a total of 200 Amps of electricity that can power everything in any given system – hell; it'll power three average gaming rigs if only it had enough connectors! It's so demanding at full load that SilverStone includes a power cable in the box thicker than my pinky finger, and if you actually have enough tech to run this at full bore you'll need to devote an entire power point on the wall to it – because it'll push the 2400W limit on Aussie plugs to bursting.

The included cables (listed beside) are exhaustive and come with more length than anyone will really need unless you're planning to scale a wall with a molex rope. Every cable is completely modular – even the 24-pin ATX cable disconnects from the PSU, making installation much easier. After all, it does weigh a whopping 4.2Kg. Rated for 80 PLUS Silver, this PSU is 85-88 per cent efficient and when running actually felt colder than ambient over the majority of the box, even under load.

Loading up a Nehalem 965 at 3.6GHz (1.375v) under OCCT load and dual 5870s in Crossfire running Vantage gave our load benchmark. At idle this collection had the 12V rail at 12.146 and the 5V rail at 5.030, but under load they dipped to a considerable 12.042 and 5.022 respectively. This is a lot of sway, but considering it's within standards it's acceptable. If you've got a burning need for the biggest and beefiest PSU out there, there simply is no other. 



Overall
Wholly impractical for most, but ultra-super-mega-power users will love it.

90%

Thermaltake Evo_Blue 750

More bling than a rap concert.

Street Price \$200 Supplier Anyware
Website www.anyware.com.au

Specifications ATX form factor; 24-pin, 4-pin ATX, 8-pin ATX, 6x molex, 6x SATA, 2x 8-pin PCIe, 2x 6-pin PCIe, modular.

Thermaltake has recently brought out a whole new range of power supplies underneath the Evo_Blue umbrella, and each one is definitely not your standard PSU. Just looking at the external appearance of these boxes is pretty telling – and those vents have to be used for something purposeful. The biggest story here is the 140mm fan that comes preinstalled with twelve LEDs, giving it RGB capability that can be controlled by a handy button on the back of the unit, or turned off completely.

The LEDs are blindingly bright, and certainly make the insides of any case look like a disco when activated, but the fan itself isn't the quietest model we've seen and does get noticeable under load. Thankfully it's also pretty darn stable, with the 12v line idling at 12.160v and peaking at only 12.167v load. The 5v line wavers even less, going from 5.103v idle to 5.09v load. Considering the testbed was

running a Core i7 965 @ 3.6GHz (1.375V) with OCCT at full, two 4890s in Crossfire running Vantage on Extreme – this was a pretty good result. Hot air was exhausted from the PSU under load.

Modular cables included are pretty good with six Molex, six SATA, two 6-pin PCIe and two 8-pin PCIe power connectors. Annoyingly the 8-pins can't be split into a 6-pin, and rather included two 8>6 converter cables. The 24-pin power cable felt a little rough to actually connect to the motherboard. 56A of power on the 12v rail provides a theoretical 672W of electricity, which is decent enough to run most gaming rigs. Oddly the efficiency of these PSUs is only 75 per cent, but they're backed by an awesome five year warranty if anything goes wrong.

Pricewise you pay around \$15 over the competition in 750W PSUs, but if you need a little bling to spice up your rig then this PSU is worth a look. 



Overall
Warm and not quite efficient, but looks and performance are solid.

84%

G.Skill Ripjaws F3-16000CL9D-4GBRH

Incredible value and great overclockers.

Street Price \$139 Supplier Mittoni
Website www.mittoni.com.au

Specifications 2x 2GB kit; DDR3-2000; 9-9-9-24; 1.65v; 240-pin DIMM; Non-ECC Unbuffered DDR3

G.Skill has been around for ages now, pumping out affordable kits of memory that haven't always overclocked well, but were very reliable. Their latest series is a dual-channel DDR3 that should have been called the whywouldyoubuyanythingelse-jaws. Coming in at a price just a smidgen off \$150,

this kit is based around two 2GB sticks of DDR3 memory running at a stock voltage of 1.65v with frequency of 2000MHz and relatively tight timings of 9-9-9-24. Since they're aimed at Lynnfield systems these can't run at stock speeds without overclocking the CPU; to reach the stock frequency a 166MHz BCLK was required.

Whacking them into MSI's P55-GD65 we increased the BCLK speed of the CPU and dropped the multiplier two steps to keep the CPU clock relatively stable, bumping up the memory frequency from 1000MHz stock to a final of 1150MHz at slightly relaxed timings of 10-10-10-28. Benchmarking at this heightened frequency didn't do much for Hexus or wPrime (both timing-dependant programs), but Everest showed great speed improvements – loading game data or even streaming a lot of data from memory to the CPU will get a nice performance increase. The heightened frequency even makes up for the difference in memory channels between Lynnfield and Nehalem, but the tiny price and great overclockability means you'll not want anything else for a great performing rig.  JR



Overall
Amazing performance memory.

97%

G.Skill Ripjaws

	2000MHz; 9-9-9-24 (1T); 1.65V-Stock	2300MHz; 10-10-10-28 (2T); 1.76V
Hexus PiFast	24.02s	24.09s
wPrime 32M 8x	6.786s	6.833s
Everest Read	19414 MB/s	21121 MB/s
Everest Write	17091 MB/s	17140 MB/s
Everest Latency	42.3 ns	38.2ns

Thermaltake Contac 29

The highest cause of death for Atomicans – pushpins.

Street Price US\$49 Supplier Thermaltake
Website www.thermaltake.com

Specifications Tower heatsink, 6 heatpipes, aluminium fins, 120mm fan included

Thermaltake has made some wacky coolers in the past (just look at its DuORB designs for a great example), but the Contac 29 is a decidedly standard tower heatsink design that fits in with the rest of the manufacturers in the market. Based around identical materials and similar features to the competition, there isn't really anything exceptional here based on features alone.

Starting with a slightly rough base, it's formed from an aluminium block with three thick copper heatpipes sanded down to merge with the aluminium – contacting the CPU directly in an attempt to take the heat directly away. It worked very well, and the heat was evenly distributed throughout the series of aluminium

fins that lie above the heatpipes. This is the typical tower heatsink idea, and isn't particularly new but has proven to be the most efficient design by far.

A single 120mm fan mounts to the fins via four silicon grommets, which hold the fan pretty securely and remove any vibration noise. This is probably a good thing, since the fan makes an unforgivably loud 63dBa at idle and 63.5dBa at load; the lack of an included fan controller means it's going to be loud 24/7. Thermaltake's more recent design ethos with its fans is quite odd, but there seemed to be little air actually making it through the rather small distance between aluminium fins.

Still, performance was not too shabby considering the fan wasn't great, managing to pass the overclocked torture test that a decent chunk of heatsinks can't accomplish. Socket compatibility is pretty nice with all major ones covered, but incredibly annoyingly it uses pushpins to mount on all Intel sockets – the crappiest plastic we've ever felt paired with awkward placement and an involved installation. These really are terrible, but for the budget-minded out there this heatsink will give some capacity for overclocking.  JR



Overall
A bit warm and tacky, but decent value.

72%

	Load	Idle
3.2GHz, 1.2V	57	35
3.6GHz, 1.35V	66	37

Samsung Syncmaster 2693HM

Bridging the gap.

Street Price \$588 Supplier Samsung
Website www.samsung.com/au

Specifications 25.5in widescreen; 1920x1200;
400cd/m²; HDMI/DVI/VGA

Samsung has never been the cheapest monitor manufacturer, but since the company makes the actual panels inside the screens (as opposed to simply assembling them) they're at liberty to cherry-pick the best and brightest panels for its monitors. The 2693HM is one that slots in just higher than the 24in screens but lower than a 27/30in, and like the AOC below is actually slightly smaller than its name would suggest, at 25.5 inches. Packed into this space is the usual resolution of 1920 x 1200 at a quite bright 400cd/m², brighter than most monitors.

The monitor itself looks quite stylish and sports a slightly glossy bezel, and can tilt back/forwards or rotate into portrait mode. It also comes with height adjustment, but the disappointing part of all this movement means that the stand and every piece of plastic creaks more than a haunted house on Halloween. The screen also isn't particularly secure and rests on two metal tabs, which meant that moving the monitor

around involved almost dropping the whole thing once or twice. Thankfully the touch-sensitive controls work just fine.

Visually this monitor is stunning, with bright, easily distinguishable colour gradients mixing with deep blacks and vibrant images. While the dynamic contrast setting ran the screen too dark or light, once disabled it was quite close to the best screen we've got to look at. Even though the pixel density is slightly lower than a 24in screen it looked very crisp, and motion was quite smooth.

Three inputs cover HDMI, DVI and VGA, with only a single DVI cable included. The two speakers built in are tiny, so stick to real speakers. The price comes in at two times that of a budget 24in and \$50 less than a 27in screen; coupled with the weak stand we recommend it for those limited on space, but if you need bigger it's worth spending more. 



Overall
Visually impressive,
physically disappointing,
a little too expensive.

86%

AOC 2434Pw

Taken through the carwash a few too many times.

Street Price \$285 Supplier AOC
Website www.aocmonitor-anz.com

Specifications 23.6in widescreen; 1920x1080;
300cd/m²; HDMI/VGA

The first thing to point out about the AOC 2434Pw is that while the name might sound like it's a 24in, 16:10 monitor, it actually works out as a slightly smaller 23.6in on a 16:9 ratio – much better for high definition movies and game consoles. It comes in at a price of \$285, about \$20 more expensive than the BenQ and Viewsonic offerings for a similar size.

Input options cover VGA and HDMI, with both cables included in the box as well as a DVI>HDMI adaptor for graphics cards. Power is supplied via an external power brick, and all connect around the back of the monitor underneath two plastic flaps that aim to keep the cabling tidy. Also built into the screen are two teensy speakers, but they're not particularly good.

Framed with a very glossy bezel that can be distracting in any brightly-lit room, the panel itself is coated in a very smooth matte layer that doesn't reflect any noticeable light. It's got a great viewing angle around most of the

monitor, but the colours were disappointingly washed out on all but the 'warm' preset, which blew out the ruddier colours. There was no ghosting at all, and blacks were only slightly grey thanks to the partially overzealous backlight bleed.

The panel is calibrated via a touch-sensitive panel at the bottom right of the screen, but this proved annoying in use as it would detect a finger about a centimetre away from the actual button, meaning that anything less than precision bumps the wrong option. Once set up it was acceptable, and the stand that holds the panel up was very sturdy and didn't flex too much. The screen is height-adjustable by 8cm, and the base can rotate without needing to be lifted.

It's an adequate screen, but not amazing. 



Overall
Not groundbreaking stuff, but
decent value. Handles motion
well.

75%

Lian Li X1000

Another case of case excellence from the masters.

Street Price \$530 **Supplier** Mittoni

Website www.lianli.com

Specifications 230 x 680 x 430mm (W x H x D); 3 x 140mm Fan (front); 2 x 140mm Fan (rear); 3 x 5.25in drive bay (external); 6 x 3.5in drive bay (internal; ATX, M-ATX; aluminium).

Gallery <http://www.atomicmpc.com.au/?154757>

It can be pretty easy to run out of superlatives when you're talking about a case as perfectly designed as Lian Li's new X1000. Drawing on the same super tower design of its even more expensive cousin, the X2000, the X1000 strips back some of the features, but loses none of the charm and utility.

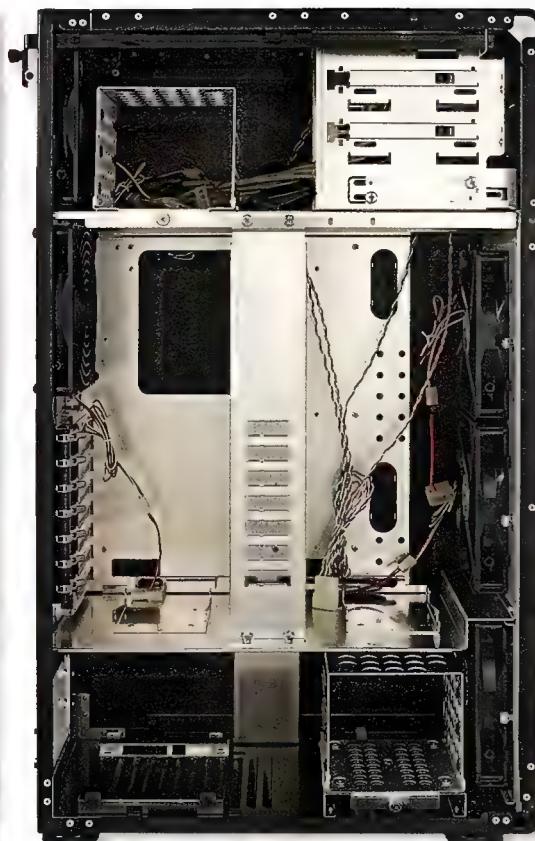
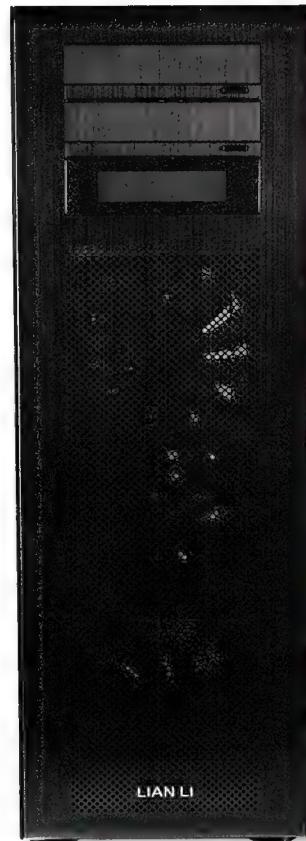
We wrote in our review of the X2000 that the side-mounted external drive bays split the office, but there's nothing to cause such contention this time around. The X1000 boasts the usual drive orientation, placing three external drive bays on the front fascia, above three 140mm fans protected by mesh and removable filters. No cat hair or dustbunnies cluttering up this case! The entire exterior is brushed aluminium, and about the only thing we can see of the semi-matte finish is that it picks up finger prints like John Romero picks up gamer chicks. The

case's rear houses another two 140mm fans, exhausting warm air, as well as eight expansion slots, grommetting watercooling ducts and a fan controller switch.

About the only thing we continue not to like is Lian Li's choice of a dinky little cover for its IO ports. Surrounded by such lush design, this annoyance stands out like a sore thumb.

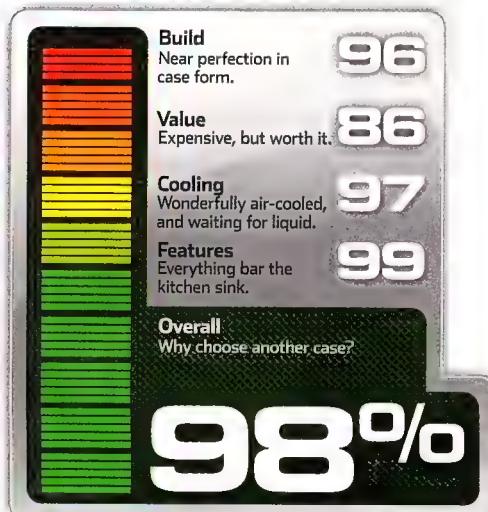
But it's easily forgotten once you remove the side panels, which are fastened with a clever system of spring loaded screws – no more losing thumbscrews.

Inside, the case is split into three discrete chambers to improve cooling and airflow. At the bottom rests a vibration damped bay for the PSU, as well as internal drive bays. The middle section is the main chamber, with removable mobo plate, expansion card bracket (a boon for larger and longer cards), while the top chamber houses more internal drive bays, and the external 5.25in bays. Every mount is tool-less and vibration damped, and the case also includes the best and most reliable tool-less latching systems we've ever seen for expansion cards. There are even brackets



for 2.5in drives, perfect for those making the move to SSD storage. And every surface is finely machined, perfectly finished, and ready to take whatever punishment you can dish out.

To say that we're once again in love with Lian Li is an understatement. The X2000 is a great case, but so expensive as to put it out of most people's reach. At \$500-odd, the X1000 is the case any serious upgrader would want to build their next PC in. It's certainly what we want to use for our next rig.  DH



Antec Two Hundred

Antec reaches into the budget end of the case spectrum, but does cheap cost mean a cheap case?

Street Price \$75 Supplier Altech
Website www.antec.com

Specifications 450mm x 200mm x 470mm (H x W x D); 6x 3.5in drive bays, 3x 5.25in drive bays, 1x front-loaded hot-swap 3.5in SATA drive bay; 1x 14mm fan (top), 1x 120mm fan (rear); 2x USB 2.0, Audio (AC'97 and HDA compatible); 6.3kg; Mini-ITX, microATX, Standard ATX; metal and plastic construction.

Gallery <http://www.atomicmpc.com.au/?152968>

You don't expect much in the way of bells and whistles when you get into the sub-\$100 price range when it comes to PC cases. Thin metal, poor cable management and basic features are the rule, not the exception, and while this new Antec case features some of the common pitfalls of the budget crowd, it still manages to deliver something unique.

The exterior is a mix of thin steel on the case panels and upper surface, and molded plastic over metal mesh on the front fascia. The hexagonal design, which slightly protrudes, on the case front is certainly a change from the more plain Antec cases of both the P-series and the higher numbered cases, but it's not one that immediately appeals to us. Of course, your aesthetics may vary, so watch your mileage. There's no LEDs to light up the mesh, either, and a simple selection of USB and audio connectors completes the case's front bevel, along with power and reset switches.

It's a basic setup, really, except for a hot-swappable 3.5in drive caddy - probably the best use of the old 3.5in mount that many cases still sport that we've seen. Normally, hot-swap bays are something you have to pay top dollar for, so

it's pretty neat to see one in such a budget model. Sure, it's bit of a tacked on solution, especially the way the PCB is secured internally, but ten out of ten to Antec for the effort.

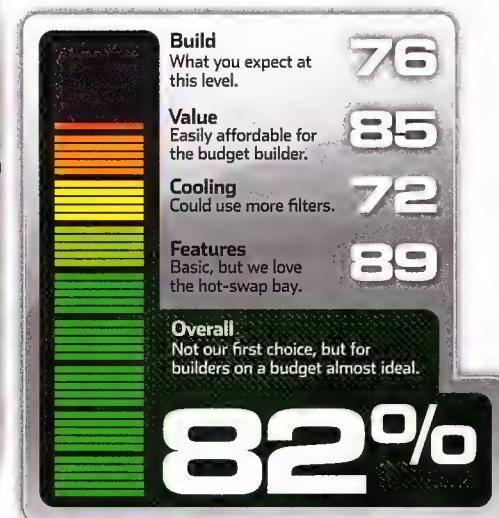
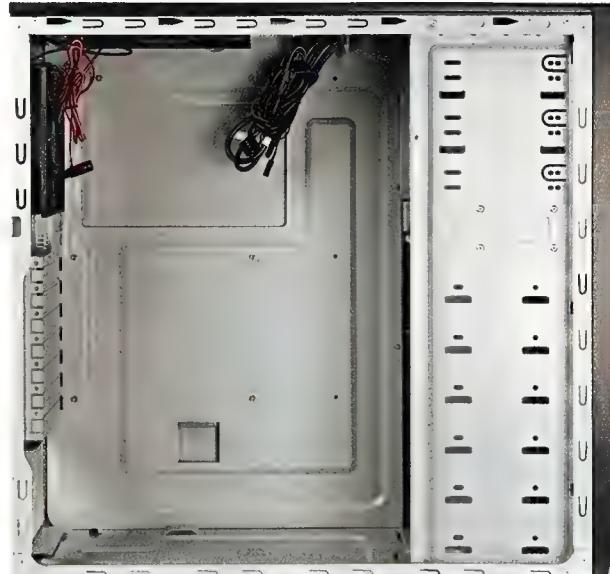
The case rear is plain grey steel, and while it does feature two holes for water cooling, there are no plastic grommets included - a very odd oversight.

Internally it's more swathes of plain steel, and the first real signs of cost cutting. Cable management, at least behind the mobo plate, is non-existent, and there's no room for even the 24- or 8-pin connectors to be snaked out of the way here. There is a lot of room to tuck cables away behind the main drive bays - and there's a good number of these - but it's not the best solution in terms of completeness or airflow. The expansion slot covers are of the twist-off variety, which is more or less expected at this level. And, we have to admit, we prefer old fashioned screws to fasten our cards over most fancy solutions.

Then again, airflow is bit of a weakness all round on the Two Hundred. With only two exhaust fans at the top and rear, and no filters on the case's front or side mesh, you'll be sucking in dust and hair all over your components, or

building it up all over the cable runs.

The Two Hundred is a very interestingly mixed bag. It's a classically lower end case in most ways, but some classy flourishes keep it above the budget pack. It's not enthusiast-grade, but you'd be forgiven for giving it a go.  DH





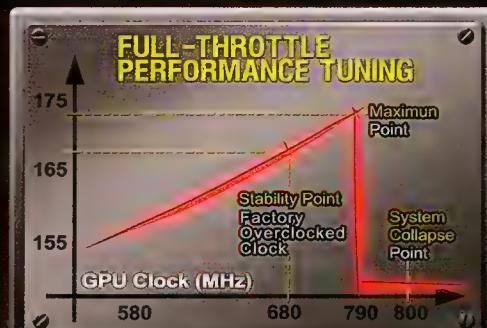
GTX 260 SUPER OVERCLOCK

**Premium Graphics Card
with GPU Gauntlet™ Sorting
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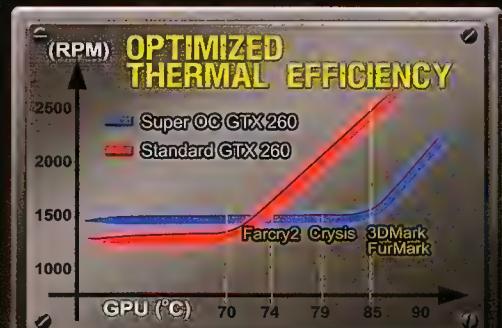
GPUs in this new range of high-end graphics cards have been cherry-picked for top performance, efficiency and reliability. Utilizing GIGABYTE's innovative GPU Gauntlet™ Sorting process ensures that only premium GPU processors are used in these graphics cards. Coupled with NVIDIA's PhysX and CUDA technology, users can rest assured that the Super Overclock Series graphics cards won't let them down when they step onto the digital battleground. GIGABYTE's innovative GPU Gauntlet™ Sorting process provides three main benefits:



Full-throttle Performance Tuning



Optimized Thermal Efficiency

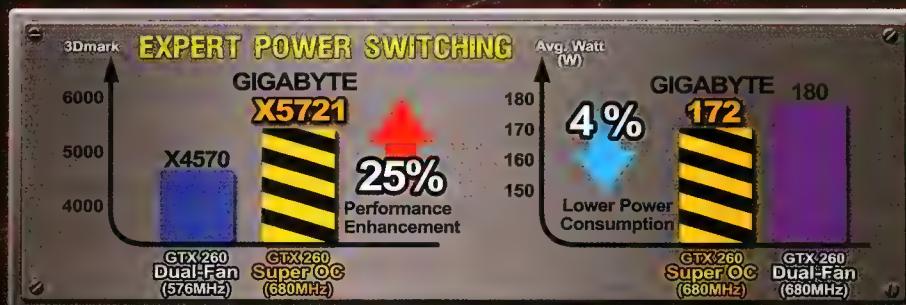


Proprietary database analysis system helps engineers investigate GPU core, shader and memory. Super Overclock Series video card sets its factory overclocked at optimal stability point (Super OC point), which is an exact balance between high frequency and efficient power consumption, delivering top performance for power users.

With high-quality GIGABYTE Ultra Durable VGA components, the processor selected by GPU Gauntlet™ Sorting boasts extra lower temperature by 5 to 10%. The guarantee fan speed at 1500 rpm in high-rated 3D and physics-accelerated games helps reduce noise for an absolute quiet environment.



Expert Power Switching



GPUs are examined and tested for the highest power efficiency and lowest power consumption using the FurMark and 3DMark Vantage benchmark. A GIGABYTE GTX 260 Super Overclock Series graphics card delivers a 25% increase in performance compared to a standard GTX 260 card. And a GIGABYTE GTX 260 Super Overclock Series card guarantees the same overclocking capability as a standard GTX 260 dual-fan video card, but with a lower power consumption.

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Logitech G940

The new king of the skies.

Street Price \$550 Supplier Logitech
Website www.logitech.com.au

Specifications Force feedback joystick; 21 switches, 4 hats, 2 rotary wheels + 3 trim wheels, 3-position mode switch; split throttle, pedal tension adjust, desk-mounting holes.

The once prolific combat flight sim genre has contracted into a handful of super high quality sims, such as IL-2, DCS Black Shark, Lock On and Allied Force, which are supported by hundreds of community and third party commercial add-ons, giving each sim a lifespan of several years and a loyal following of ardent fans. It's to this market that Logitech has gifted the G940.

It's a HOTAS (Hands On Throttle and Stick) device, so the idea is that you can do everything you need without lifting your hands from the controllers. The advantages in combat are obvious, equally so the immersion factor. Literally hundreds of commands can be bound to the device via different mode overlays (joystick equivalent of SHIFT, ALT and CTRL), as well as complex macros via the mature Logitech Profiler software. If you're buying this, you're likely intending to play just your one or two favourite sims, so you will spend the time mapping it all out, or, downloading a profile someone else has kindly created and mastering it. Once done, you'll have under your hands complete control over avionics, navigation, communications, radar, weapons – everything.

The G940 is an interesting and compelling product in a few ways. Most apparent is the



DCS Black Shark models damage into its flight model; in testing I had a missile hit on the left of the chopper, creating drag to that side which the G940 replicated, pulling the chopper left and introducing a rough shuddery ride. It really is brilliant, and done so artfully that you instinctively

for the 99 per cent of the time you just want one control. There are two indents, one for idle and one at the top for burner. Two wide-ranging rotary wheels and two hats onboard are tremendously useful, as are the eight buttons on the base, which can be programmed by you to light up in different colours depending on the use. Logitech also provide small cardboard tabs to write the function you assign and slip under the plastic button cover. Nice touch.

The package is purchased in one lot with the pedals, a wonderful inclusion. Stick twisting for rudder is just wrong, and the control advantage pedals impart, particularly for choppers, is one of the greatest immersion experiences you'll ever have in a game, as every part of your body 'becomes' the plane.

Logitech excels with thoughtful design, innovation and high quality for a reasonable cost. The G940 embodies all these traits and is a must-have for any hardcore simmer.  BM

Slow down too much, and you'll feel the plane start to lose energy and wallow as you approach stall, and then let go completely...

Force Feedback joystick, an ultra-cool feature we haven't seen in a stick before. A wide range of effects are supported, and all are adjustable for intensity. So, yes, it does shudder like a bastard when you're firing guns, it'll also give you feedback when taxiing and run off onto the grass. Most usefully, though, is the feeling of flight energy and dynamics.

In a supported game the stick is constantly 'motorised'. You can feel a certain tension as you fly, as the stick feeds flight sensations at all times. Pull up hard and it proportionally stiffens as g-forces increase the 'weight' of the plane. Slow down too much and you'll feel the plane start to lose energy and wallow as you approach stall, and then let go completely when you do stall. You will know the plane is a fluttering leaf, but gradually feel it come back as lift is regained.

switch your brain into flight mode, enjoying the task of controlling a bird like never before and appreciating all the more the fine flight dynamics of your favourite sim.

The stick itself is reminiscent more of the CH Products pure and simple design ethos, than of the Thrustmaster Cougar's all-out fighter stick replica, or Saitek's Buck Rogers inclination. It's got a fine rubbery coating that's nice to hold and the stick is quite skinny. You'll quickly feel at home with it. The buttons are all perfectly positioned, so there's no lifting your hand a bit to reach the top buttons. There's three 'trim' wheels mounted behind the stick, which spare you a hat for that task, though in use I was accidentally hitting the pitch trim with my wrist from time to time.

The throttle is a split design, which is great for twin engine aircraft. The levers lock together

Overall

Flight sim enthusiasts either have one already or lust for it. Just the thing to get new fans into the genre.

90%



Scorptec Redback Limited Edition

A scorcher of a Core i7 870-powered beast.

Street Price \$2575 **Supplier** Scorpion Technology
Website www.scorptec.com.au

Specifications Intel Core i7 870 (2.93GHz); Gigabyte GA-P55-UD5; 2x2GB PC-10600 (1333MHz) Corsair RAM; Gigabyte GeForce GTX275 896MB; 60GB OCZ Vertex Series SSD and 1TB Western Digital Caviar Black SATAII; 24X Liteon DVD Burner; Fractal Designs Define R2 Case; Corsair 620W HX Series.

Gallery www.atomicmpc.com.au/?155833

Scorion Technology has been really impressing us recently, and this new P55-powered system – the Redback Limited Edition – continues that trend. From our first unboxing, through to testing and maybe a touch of gaming (all in the name of science!), we've really enjoyed this PC.

Scorptec's gone with a very interesting case choice, with a case by Atomic newcomers Fractal Designs. It's got a touch of the Antec's about, from the very solid door on the case's front fascia, through to the dual fan mounts in the front, but the really neat thing about it is the sound-proofing – and man, does it work.

The case door features grey foam by way of insulation, and the side and top panels are coated in old garbage bags. Sounds a bit dodgy, but it's a reclaimed material made from recycled plastic. It's kind of funkily ribbed and rippled (quite possibly for your pleasure), and it turns the Redback into just about the quietest machine to grace our test bench. It's a touch heavy, but if you're not moving your case much, you'll barely notice.

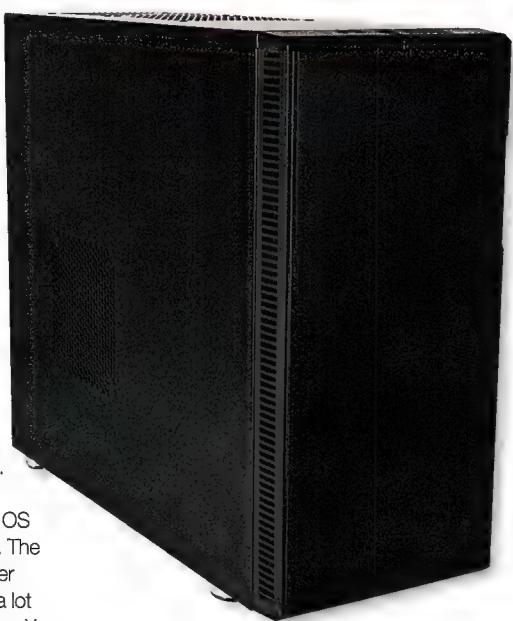
Inside the case all components are neatly cabled and very well chosen. Scorptec's gone with a Gigabyte-made mobo and graphics combo, so you're definitely getting quality parts. Annoyingly, this is the one Gigabyte board we've not looked at yet, having reviewed the model above and below, but if they're any indicator, this one's just as good.

The 870 is a great chip – it's in our KitLog for a reason – and backed by 4GB of Corsair RAM, it's not going to lack for bits. And speaking of RAM, thankfully the builders at Scorptec have opted for a 64-bit version of Vista, with Service Pack 1 installed. You'd think that's pretty basic stuff, but we still a lot of systems with more RAM than the OS can address, and un-installed Service Packs. The GTX275 is a good choice, and while we prefer the 4890, it's more than capable to pushing a lot of pixels, and has the added advantage of PhysX and CUDA.

The storage subsystem is an SSD backed by a huge 1TB standard HDD. This means that the OS, running of the SSD, responds quickly and smartly, and the game or two you can fit on there will also load like the clappers – our benchmarks fired up faster than ever. Seriously, SSDs are the way for any system builder to go.

But how does all this hang together in all important testing? Pretty bloody well!

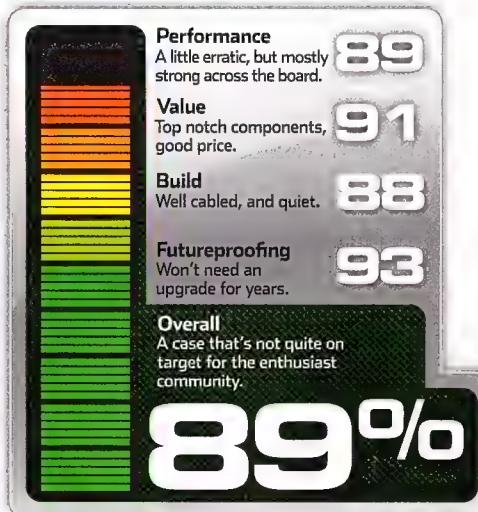
It's not ground-breaking, but for the price-point you're getting good results. Vantage struggles a little, hitting only 12950, but



3DMark06 performance positively soars, getting 18,368 3DMarks. Oddly enough, compared to the GTX295-powered DCA Skeleton from issue 93, this is less in Vantage, and more in 06.

With Crysis, we're thinking that in this new Core i7 age we need to up our testing screen res, so that we can give test systems a more meaningful workout. It's still in work in progress, but for this instance we set Crysis to 1920 x 1050, no AA, and the Redback still pushed out a pretty playable 23fps, with all settings set to Very High. Now that's performance – a bit of tweaking will get this well into the 30fps margin.

Comparing again to the DCA Skeleton, for much the same money you are getting a cutting edge CPU, which overclocks wonderfully, a really interesting case choice, and quietly performing gaming machine. Some performance is down, but for the most part this is the true sweetspot of computing at time of writing. 



Overclocker Codex: Core i7

Vito Cassisi releases the full potential of your Core i7 rig.



It was not long ago that we delved into the general method of overclocking using the BIOS and Windows operating system. At that time the Core i7 architecture was still under speculation, and rumours arose that Intel would constrain overclocking altogether. Fortunately for enthusiasts across the globe this never came to light, and we're free to tweak this amazing new platform to a great extent. In fact, these chips overclock stunningly well for a quad core CPU, even if they do get a bit toasty.

The five current models of the Core i7 range include the 920, 940, 950 and the extreme editions 965 and 975. While there is a new entrant into Core i7 in the form of the 870, this is based on LGA1156 and the P55 socket; this guide will only cover

LGA1366-based systems. The main difference between the CPUs is their multipliers. The 920 is restricted to 20x (21x with 'Turbo Mode' enabled, and reportedly 22x when only a single core is enabled), the 940 is set to 22x, and the 950 at 23x. The 965 and 975, Intel's flagship 'extreme edition' CPUs are unlocked completely. That is, they can be set to any multiplier value.

Having a larger selection of multiplier values aids the process of attaining the highest stable CPU clock speed, without relying on factors such as the RAM and memory controller hub (MCH). Intel realises this, and has priced its high-end CPUs ridiculously higher than the budget-oriented 920. In fact, the 940 (\$845) is essentially more than double the price of the 920 (\$366), while the 965 (\$1699) is double

the 940. If the performance followed this price deviation, then such processors could be considered a feasible – nay, mandatory! – investment. Unfortunately, this is not the case.

Most overclockers opt for the cheaper 920, which is capable of hitting 4GHz on air cooling. Sure, the other two CPUs may overclock slightly higher (unless you intend to use vapour phase change, LN2 or DICE cooling solutions), nevertheless this advantage rarely justifies the exuberant cost – unless you're out to break records. After all, overclocking is all about grabbing the best value kit and pushing it to within an inch of its artificially fabricated life.

This guide delves into the new terminology introduced by the Core i7 architecture – what it means, how to use it, and why it changed. And now, we learn!

Hardware Compatibility

As it stands, not all motherboards allow overclocking of the CPU and RAM. This is generally the case for OEM PCs from major brands such as Dell or Acer. If overclocking, ensure your hardware is capable. This may include searching for your motherboard (or OEM PC) model number on an Internet search engine.

RIP FSB

Enthusiasts are far from saddened by the loss of the relic known as the Front Side Bus. This high latency, high clock bus has been the backbone of the Intel platform for an incredible amount of years prior to the introduction of the Core i7 architecture. The main advantage of this bus was the ease of overclocking.

The FSB determined the speed of the CPU core(s), the memory controller hub (MCH), system RAM, and the transfer between devices like PCI-e expansion cards. You could essentially overclock your whole system by adjusting this one value. Components could be 'locked' to prevent change, or had accompanying multipliers/dividers to fine tune the resultant clock speeds. Voltage settings were used to maintain stability.

Intel realised that this solution needed to be revamped. The FSB wasn't designed for high bandwidth while also maintaining low latencies. So its engineers took a leaf out of AMD's book and introduced an on-die MCH, with a point-to-point interconnectivity system known as the QPI.

New Jargon

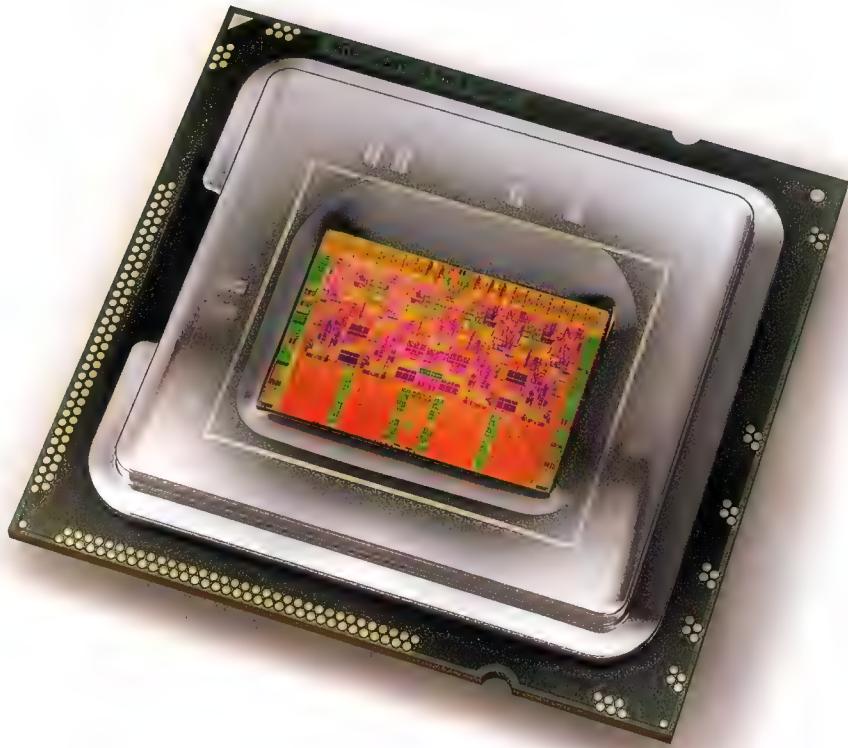
Along with this new architecture comes new terminology. For instance, the rough equivalent to the FSB is the BCLK.

BCLK (base clock): The QPI bandwidth, uncore, CPU and RAM clock speed are based on this numeric.

QPI (Quick Path Interconnect): The QPI is the connection between the CPU(s), I/O controller (e.g. the x58 chipset) and memory.

Core i7 870 changes

The Core i7 870 is indeed a Core i7 chip, but is instead based on the LGA1156 socket that itself is built around the P55 Express chipset. Removing the Northbridge component from the equation means that the QPI is no longer applicable to it; rather the Baseclock (BCLK) speed is the only value that determines speed. Found by multiplying the BCLK by the CPU multiplier, this means that only the vCore, vDIMM/DRAM, PLL and ICH core voltages are applicable. Overclocking is a much simpler affair, so this makes it a very attractive choice for those not yet upgraded to X58. Also keep in mind that heatsinks are not necessarily compatible between LGA1156 and LGA1136, so cooling will have to be checked beforehand.



A higher QPI clock allows for more data to be transferred each second. QPI clock generally provides sufficient bandwidth at stock speeds.

Uncore: The term 'uncore' refers to anything on the CPU die which isn't the core of the CPU. CPU cache and the MCH run at the speed of the uncore clock.

Deriving Component Clock Speed

Now that we've established what each component does, we can overclock them accordingly.

These multipliers are typically limited in range, and are often set to 32x to ensure overclocking headroom when the BCLK is increased.

Uncore

The uncore runs on its own multiplier, in respect to the BCLK. According to Intel the uncore must remain double the memory clock to ensure sufficient bandwidth.

$$\text{Uncore} = \text{uncore multiplier} \times \text{BCLK}$$

Memory

Memory speeds can be found via:

$$\text{Memory (RAM)} = \text{BCLK} \times \text{memory multiplier}$$

The FSB determined the speed of the CPU core(s)... You could essentially overclock your whole system by changing this one value.

BCLK

The BCLK is an integer which can be directly set in the BIOS, or via Windows. Changing the BCLK will affect QPI, RAM, uncore and CPU speeds. For example, a PC running a 20x CPU multiplier, and a BCLK of 150MHz, would result in:

$$\text{CPU} = 150 \text{ (bclock)} \times 20 \text{ (CPU multiplier)} = 3000\text{MHz (3GHz)}$$

QPI

The QPI can be calculated by the equation:

$$\text{QPI} = \text{BCLK} \times \text{QPI multiplier}$$

Memory speeds are indirectly affected by the CPU multiplier. If the CPU has a limited or locked multiplier, the BCLK must be increased to achieve higher memory speeds. This BCLK alteration will then affect the memory clock, in accordance to the equation above.

Every time the memory multiplier is increased, the RAM speed is increased by twice the BCLK. Considering the stock bclock is 133MHz, each memory multiplier increment raises the memory speed by 266MHz, which is a hefty jump. Alternatively, raising the BCLK will increase the

Nasty Voltages

The QPI/vTT and vDIMM voltages need to be adjusted in a specific manner. The QPI/vTT voltage will quickly fry your CPU if it is not set to a value within .05v of the vDIMM. Restricting the voltage this way prevents current migration issues within the CPU.

vDIMM is quite sensitive to being raised. A vDIMM value of above ~1.65v is said to cause damage to the CPU (according to Intel, who probably knows a thing or two). This of course poses an issue to those who have DDR3 RAM that demands 1.9v to run at stock. It is believed that raising the QPI/vTT to within the voltage range of .03v - .05v mentioned above will allow 1.9v to be safe. Getting RAM modules rated at 1.65v or lower is recommended, particularly since the high QPI/vTT will cause excessive heat.

Some motherboards do not have the option for 1.65v, but instead have 1.66v. The latter is fine, factors such as vdrop/vdroop will lower the voltage slightly anyway.

memory speed by several clock cycles. For example, a given PC is set to 133MHz BCLK and 10x memory multiplier. The BCLK is raised to 150MHz:

Memory clock speed before: $133 \times 10 =$

1333MHz

Memory clock speed after: $150 \times 10 =$

1500MHz

Difference in BCLK: 17MHz

Difference in memory clock: 167MHz

Alteration of the BCLK is required when overclocking the CPU, unless the CPU in question has an unlocked multiplier. Lowering the memory multiplier to combat this rise in speed results in the following:

$150 \times 8 = 1200\text{MHz}$ (the memory becomes underclocked)

Remember that the memory multiplier can only increase/decrease in steps of two. Methods of combating this often unwanted behaviour will be discussed later.

Memory Latency

Memory latency is a fiddly setting. There are five main variables involved:

T – Command Rate

CAS – Column Access Strobe

tRCD - Row to CAS Delay

tRP - RAS Precharge

tRAS – Row Access Strobe

Generally, a tighter latency (lower values) will yield improved performance. On the other hand, loosening latencies (increasing their value) typically allows a higher stable clock speed. Since overclocking of the CPU involves modifying the BCLK (which affects the memory), it is best to work out the maximum CPU clock speed before tweaking RAM. Why is this? Well once you know the highest speed of the BCLK, the RAM can then be tweaked and eliminated as an instability accordingly. If the RAM clock speed must be large to accommodate the CPU clock, then the latencies will often need to be loosened. By the same logic, a lower clock speed will benefit from tighter latencies.

For a system with overclock:

CPU = 4000MHz

CPU Multi = 20x

Bclock = 200MHz

The RAM clock speed adjustments will increment by 400MHz, due to the nature of

the memory multiplier. These jumps are huge, and will likely force you to use a clock speed well below the maximum capable limit of the RAM. But this isn't all bad news, the lower clock speed allows for tighter latencies. Tighter latencies allow for faster access time, and overall improved transfer speeds.

Voltages

Clock speeds cannot increase indefinitely. They're limited by the voltage, heat and architecture of the component in question. Luckily, heat and voltage are easily managed. Larger voltages allow for a higher stable overclock, but in turn produce extra heat. Cooling solutions to combat this issue will be discussed further on.

The Core i7 architecture features an array of voltages to adjust, as well as a few important considerations to keep in your noggin while altering them. These must be taken into account to avoid damage to the CPU. The main voltages you'll tweak include:

vCore – The voltage of the CPU cores.

CPU PLL – Controls the amplitude of the phase-locked loop clock signal. A higher value helps to differentiate between 1 and 0 (binary) signals. This is particularly useful once the clock speed and vCore have been raised significantly. (Intel recommended maximum: 1.9v)

vDIMM/DRAM – Dual Inline Memory Module (DIMM) voltage. To put it into layman's terms, DIMM are the RAM sticks. Increasing this may make RAM stable at higher a higher clock speed. Most kits for Core i7 run at a stock voltage of 1.65v.

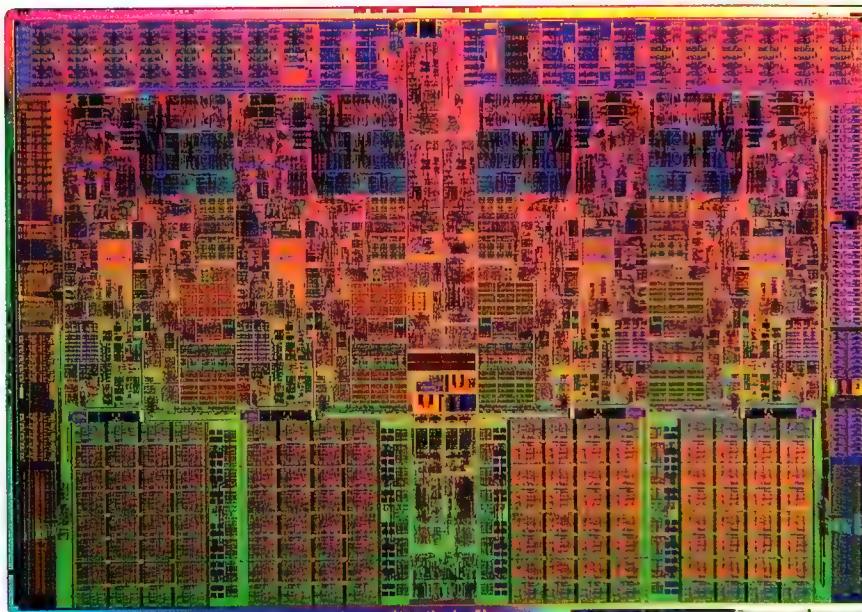
QPI/vTT – The uncore voltage. Affects QPI, bclock and RAM stability. (Intel recommended maximum: 1.45v)

QPI PLL – Similar to CPU PLL, except in regards to the QPI. (Intel recommended maximum: 1.2v)

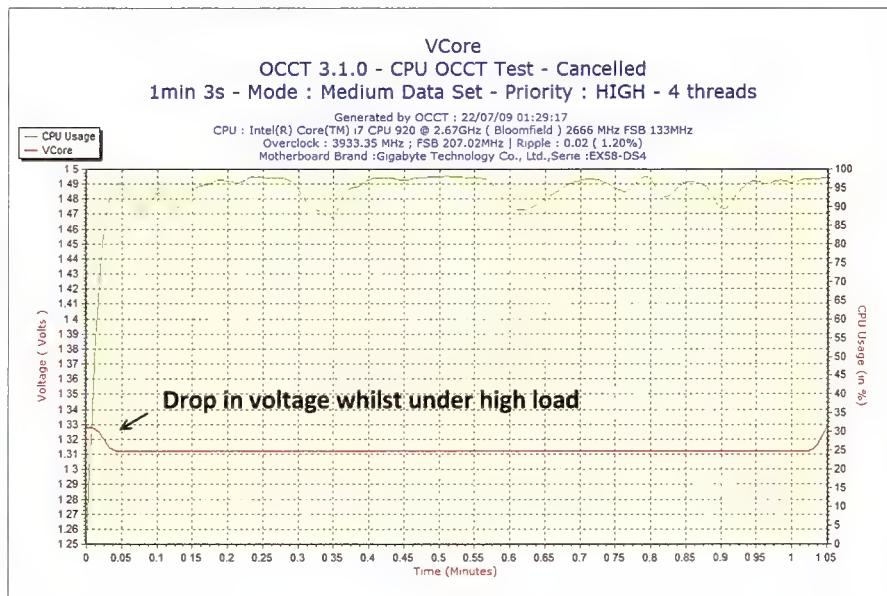
IOH Core – Voltage of the Input/Output Hub. When using high speed RAM (a large clock speed, tight latencies, or both) it is often necessary to lift this voltage. (Intel recommended maximum: 1.3v)

ICH I/O – Voltage for I/O devices, mainly affects onboard RAID controllers. This may have to be increased if using a high performance storage setup such as RAID 0. However, it is recommended that a dedicated RAID card be used instead. (Intel recommended maximum: 1.6v)

ICH Core – This voltage also affects storage devices. It may need to be raised if several storage drives are connected in conjunction with a large overclock. (Intel recommended maximum: 1.2v)



Core i7's die is massive, including four cores with a triple-channel memory controller and a buttload of cache.



Intel's X58 chipset block diagram clearly shows which components are influenced by the IOH and ICH chipsets, and their inherent voltages. It may be handy when pin-pointing the cause of instability issues.

Voltages marked in red need an extra warning. As with all voltages, increasing them too high will cause damage. However, these voltages can cause damage if not within specific constraints. See the boxout 'Nasty Voltages' for details.

vdrop and vdroop

The voltage set in the BIOS doesn't necessarily reflect the true voltage applied. The reason for this is vdrop, a term that describes the discrepancy between the BIOS set value, and the true voltage applied to components. The solution involves raising the voltage to combat what was lost. Programs such as CPU-Z and OCCT report the true applied voltage.

vdroop is the measurement of voltage lost under component load. vdroop comes into effect during high CPU load, and can be clearly seen during stress testing.

Vdroop and vdrop can be 'fixed' using pencil modifications. This involves shorting out specific areas of the motherboard to

Alternate Terminology

Manufacturers tend to name elements in their own BIOS differently to competitors. This guide uses the GIGABYTE terminology in correlation with Intel's official names. The differences are minor, apart from the following key elements:

bclock = BCLK (GIGABYTE/ASUS)
vDIMM = DRAM (GIGABYTE/ASUS)
QPI/vTT (GIGABYTE) = QPI/DRAM (ASUS)
QPI multiplier = QPI Link (GIGABYTE/ASUS)

These include, but are not limited to:

- Baseclock (BCLK) clock speed
- CPU multiplier
- Memory (aka DIMM/DDR/DRAM) multiplier
- Latency settings
- A multitude of useful voltages

Everything required to overclock the CPU and RAM is provided within BIOS setup.

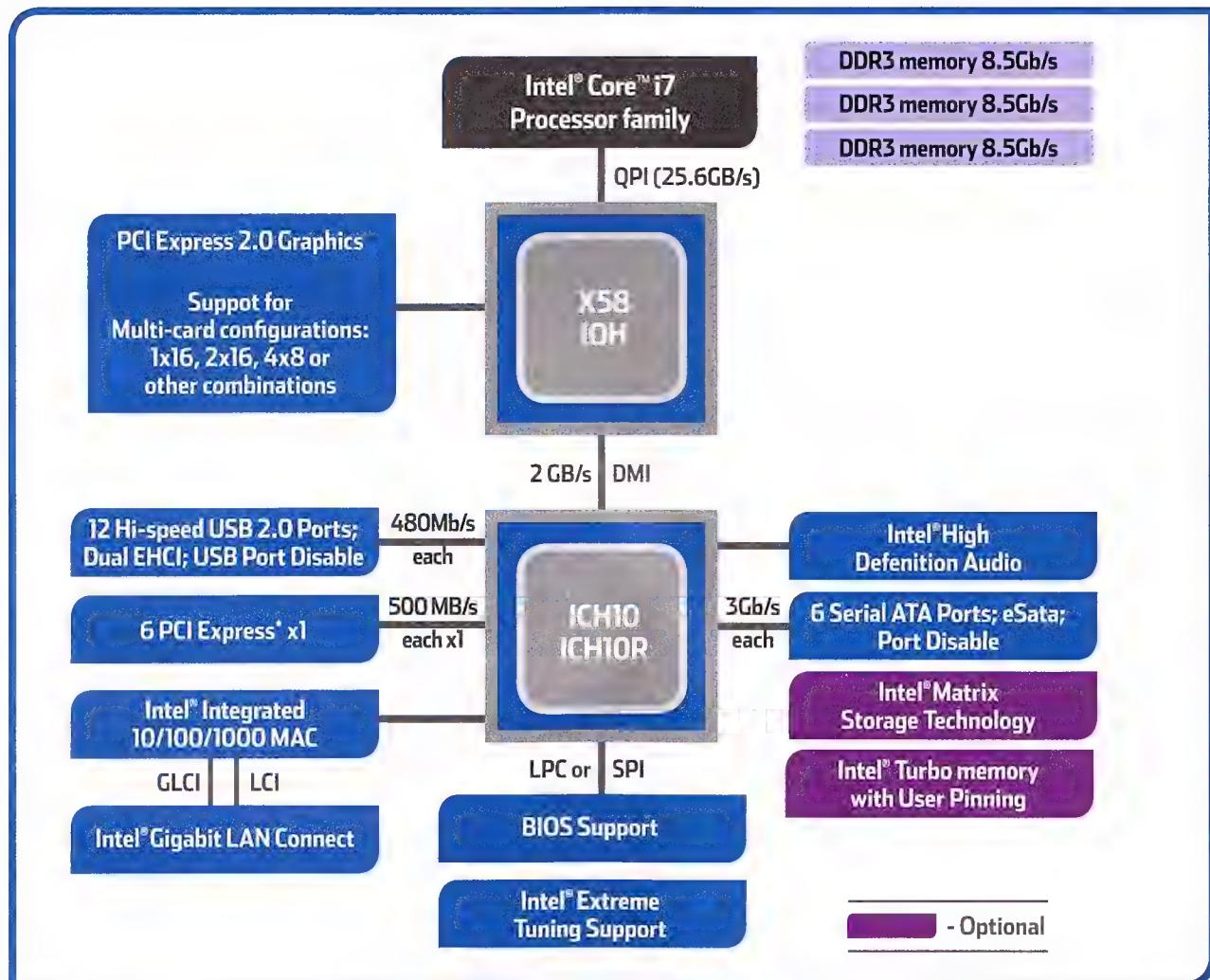
Getting access to the BIOS is typically achieved by pressing [Del] during Power On Self Test (POST). The POST screen informs the user of the appropriate key(s) to press to enter BIOS setup, for example:

Press DEL to enter SETUP

When overclocking, settings changed in the BIOS may cause failure to boot. This is resolved by clearing the CMOS. Some motherboards have a dedicated CMOS clearing button. Others either require a 'jumper' pin short, or the CMOS battery to be removed. Check the motherboard manual for more information. Core i7 motherboards are modern in design, so it's likely that a dedicated clear CMOS button exists on the I/O panel.

Contrary to common belief, having the latest BIOS isn't necessarily optimal. While a new BIOS may improve stability and add extra functionality, they may also limit overclocking ability. It's best to try older BIOS versions if overclocking becomes prematurely unstable compared to overclockers with similar gear.

Load-Line Calibration		[Disabled]
CPU Vcore	1.23125V	[1.35625V]
QPI/Vtt Voltage	1.150V	[1.380V]
CPU PLL	1.800V	[1.840V]
PCIE	1.500V	[Auto]
QPI PLL	1.100V	[1.160V]
IOH Core	1.100V	[1.140V]
ICH I/O	1.500V	[1.500V]
ICH Core	1.100V	[1.100V]
DRAM Voltage	1.500V	[1.760V]
DRAM Termination	0.750V	[Auto]
Ch-A Data VRef.	0.750V	[Auto]
Ch-B Data VRef.	0.750V	[Auto]
Ch-C Data VRef.	0.750V	[Auto]
Ch-A Address VRef.	0.750V	[Auto]
Ch-B Address VRef.	0.750V	[Auto]
Ch-C Address VRef.	0.750V	[Auto]



Intel® X58 Express Chipset Block Diagram

That being said, it must be stressed that not all CPUs are made equal. A small discrepancy may mean your CPU is genuinely at its limit.

Cooling

Overclocking generates a significant amount of heat. The stock cooler is inadequate for large or even moderate overclocks. The maximum recommended overclock with the stock cooler (depending on ambient temperatures and CPU stepping) is about 3.2GHz - 3.5GHz. After this point, the heat produced and voltage required becomes significantly higher.

Aftermarket cooling is strongly recommended. The ThermalRight Ultra 120 eXtreme with 1366 mounting bracket is the current best-of-breed air cooler. It should be combined with a high performance fan such as the 2000RPM or 3000RPM Scythe Ultra Kaze. Other solutions include water cooling and vapour phase. On the other hand, you have the temporary (and rather extreme) solutions such as Dry Ice (-78 degrees Celsius), Liquid Nitrogen (-210 degrees) and Liquid Helium (-272 degrees, too cold for Core i7).

Air cooling is typically sufficient for a 4GHz

overclock, and often even higher with a D0 stepping CPU. Intel states that the temperature threshold for their current i7 CPUs is 68c, but overclocking should be halted when temperatures reach 80c.

HyperThreading and Power Saving

Core i7 marks the return of HyperThreading, first introduced with the Netburst architecture, and omitted from the Core and Core 2 architectures. Similar to its prior implementation, the technology boasts a 10 per cent increase in performance when utilised. HT allows each core to have an associated virtual core, which utilises otherwise wasted clock cycles. Unfortunately HT also significantly increases the heat output of each core, and performance increases are only notable with applications capable of scaling across the eight total cores. Even in this day and age, we're still struggling to see programs utilising dual cores, so turning HT off to get better temperatures is more than likely the best option.

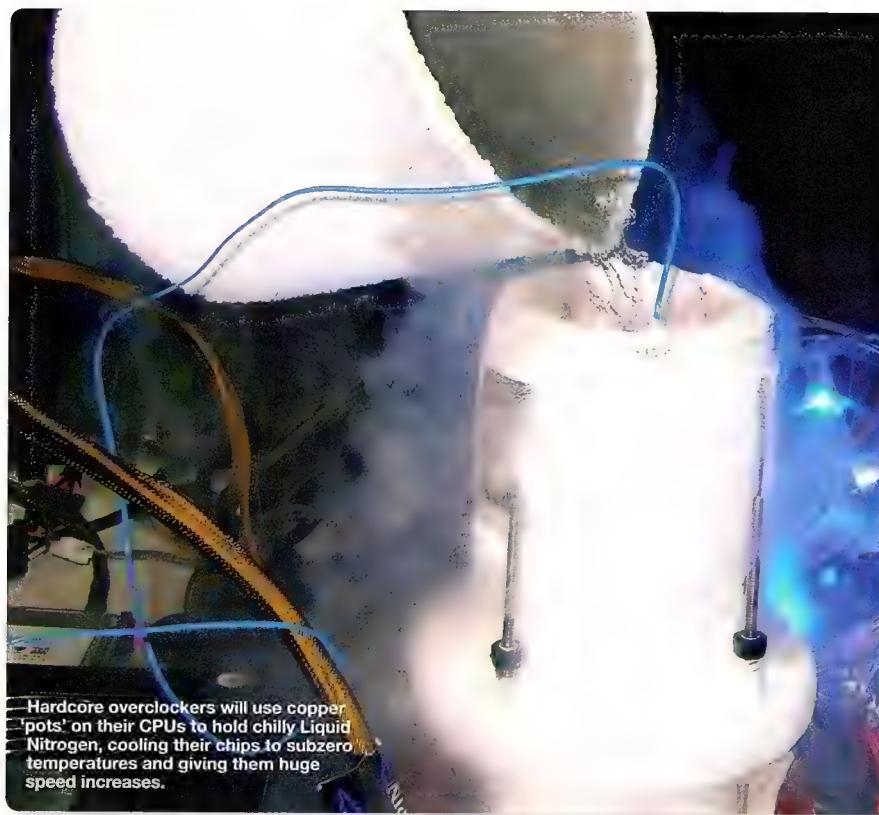
Copyright 2008 Intel Corporation

Power saving settings such as SpeedStep frequently confuse novice overclockers. SpeedStep lowers the clock speed of the CPU when it's not under load. This causes clock speed readings well below that set in the BIOS. Overclockers tend to turn all CPU based power saving settings off to avoid throttling of the CPU, thus removing discrepancies between Windows CPU readings and those set in the BIOS. Check the motherboard manual for information about adjusting power saving modes.

CPU Stepping

The stepping indicates the revision version of a CPU. This is particularly useful for overclockers. The stepping often has a significant bearing on how far a CPU can be pushed before becoming unstable. C0 and D0 make up the two stepping choices on the market. The D0 stepping clocks higher at lower voltages, making it the best choice.

Intel doesn't display the stepping on its CPU packaging, rather printing a code such as "SLACR". Instead, you'll have to search the Intel site for the appropriate sSpec# (Sample specification number) at www.tinyurl.com/intelstepping



Walk the Talk

Now that the theory is out of the way, it's time to get started on the overclocking!

Note: For all examples mentioned, the CPU is an Intel Core i7 920, and the motherboard a GIGABYTE X58-DS4 (unless otherwise noted).

The general series of steps to follow when overclocking include:

- Find the maximum stable bclock
- Overclock the CPU
- Overclock the RAM
- Adjust Latencies

You must complete each step before continuing to the next, otherwise too many variables are introduced at a single time, causing a world of stress.

Overclocking the CPU

As explained in the theory section, the process of overclocking the CPU involves adjustment of the CPU multiplier and bclock. CPUs with unlocked multipliers are easier to overclock, and hence the following steps will focus mainly on the locked multiplier variants. Fortunately the process is very similar, and any discrepancies between the two will be explained throughout.

Note: Before raising any values, all 'auto' settings should be removed. Change anything set to 'auto' to its respective stock voltage setting. The only exception to this rule is the uncore multiplier, which is handled as expected on auto, and any voltages which have not been mentioned in this guide. The QPI PLL may also be left on

'auto'. GIGABYTE motherboards have the setting 'normal', which achieves the same result.

Before overclocking the CPU, the vDIMM must be raised to meet the manufacturer's specifications. Most modern DDR3 RAM will require 1.65v. At 1.65v, the vQPI/vTT must be increased to avoid damage to the CPU (see 'Nasty Voltages'). A voltage value of 1.34v vQPI/vTT is safe, and in most cases enough to yield a stable 4GHz on the CPU.

The bclock affects many components, which makes finding its maximum stable clock speed a necessity. Raise the bclock to 200MHz. Notice how the CPU clock will jump significantly at this speed – we don't want this to be the case just yet. Lower the CPU multiplier to return the CPU to stock speeds, or thereabouts. It's essential to have everything as close to stock as possible, otherwise the source of any instability becomes difficult to target.

Similarly, the RAM speed would have raised a significant amount. Lower the memory multiplier to prevent ram instability. If it's difficult to get it close to stock (which is likely, since the bclock is so high), opt for the smaller clock speed.

Save and exit the BIOS (F10). If the system can't post or the PC freezes or BSODs at any stage, re-enter the BIOS and lower the bclock by 5MHz. Repeat this until the PC boots as expected. Remember to adjust multipliers to keep the CPU and RAM as close to stock as possible.

Download and run OCCT, a stress testing program used to determine stability. Run OCCT's 'LINPACK' test for 15 minutes (choose infinite test, and cancel when fifteen minutes

has passed). If the PC remains functional during that time (i.e. no BSOD, crashes, freezing, or OCCT errors), raise the bclock further and test again. Otherwise lower the bclock and retest.

OCCT also reports the temperature of each core. Intel rates the Core i7 for 68c maximum – try not to exceed this.

Now that highest stable bclock is known, calculating the CPU and memory speed becomes easier. In the case of the example below, the bclock maxed out at 211MHz. When used in the equation explained earlier, we can determine how large the multiplier must be to hit the aforementioned 4GHz:

$$\text{CPU clock speed (4000MHz)} = \text{CPU multiplier} \times \text{bclock (211MHz)}$$

$$\text{CPU multiplier} = 4000/211$$

$$\text{CPU multiplier} = 18.957 = \text{approx. 19}$$

Keep in mind that a lower bclock with a higher CPU multiplier can be used if appropriate.

Note: Many overclockers report issues with the stability of the 20x multiplier when the bclock is increased. Be sure to try a 19x multiplier in conjunction with a higher bclock if you encounter instability, particularly at large clock speeds.

Getting to 4GHz isn't a one step process. Increase the multiplier by one increment, set the vCore to 1.35v, then test for stability while watching CPU temperature. Continue incrementing the multiplier until stability is lost.

For the purpose of this example, assume that the multiplier is unstable at 19x. This is either caused by the CPU cores themselves, or the QPI. The vcore of 1.35v is moderately high, and shouldn't be raised any higher on air cooling. If the cooler being used is producing temperatures within the 68c threshold, a vcore of up to 1.4v may be considered. In most cases, 1.35v is plenty for 4GHz.



The best and most reliable way to measure voltage is with a multimeter - just stick the prongs into the motherboard at the correct location and get accurate, realtime readings!



If instability is still an issue, increasing the QPI/vTT may be necessary. Set it to 1.36V and attempt another stability test. If it fails, it's possible that the CPU may have reached its limit.

If the overclock went well, the system should be running at 4GHz. At this stage, we can improve the temperature output by lowering the vCore one step at a time, and checking for stability. Once the lowest stable vCore is found, the same process can be performed on the QPI/vTT, while ensuring that it stays within 0.5v of the vDIMM.

Once the CPU has become stable at minimal voltages, run Prime95 for a few hours alongside RealTemp. Perform all three provided stress test types to confirm stability. If everything is running as it should, it's time to move on to the memory. Otherwise you may have to increase

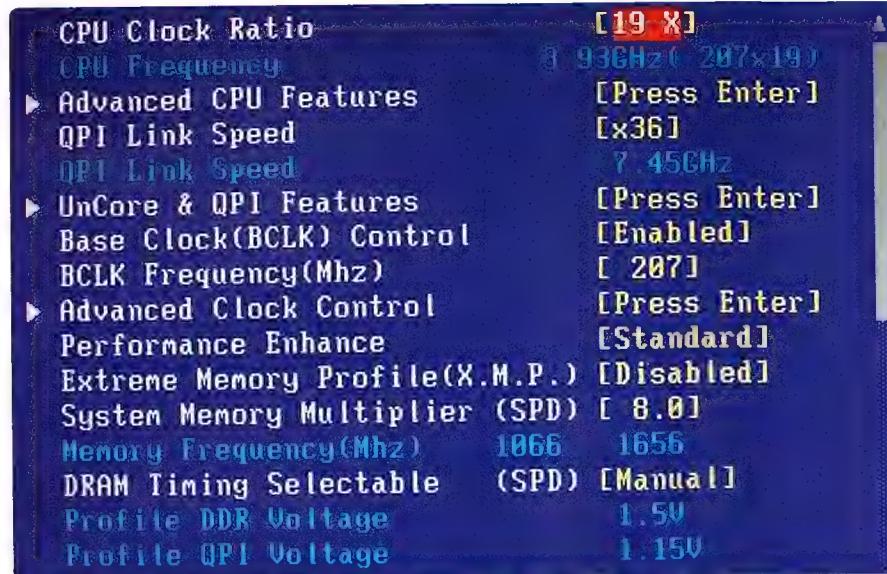
voltages slightly (remember, one at a time).

Overclocking the RAM

Memory is often sufficiently fast at stock, which is why we've assigned it a lower priority compared to the CPU. At this stage the only way to alter the memory speed without affecting the CPU speed is to adjust the memory multiplier. Depending on the bclock value set, the memory multiplier may not have sufficient increments for a stable overclock. In this case, the memory can either:

- Have its latencies loosened to allow for a larger clock speed.
- Have its latencies tightened and use a smaller clock speed.

As explained in the theory section, the process of overclocking the CPU involves adjustment of the CPU multiplier and bclock.



Choosing between the two is quite simple. If a) doesn't provide sufficient stability and/or performance, then try b). Likewise, if your memory multiplier provided a stable overclock without these adjustments, you could attempt a larger overclock using a), or improve the performance of that overclock using b).

Note: Increasing the vDIMM above manufacturer specifications may allow for a larger overclock. Be mindful of the QPI/vTT during the process.

Stress testing the RAM involves running the Prime95 'blend' test. Run this for at least an hour to ensure stability. It is also recommended that Memtest86+ be run for an hour following this. Remember to keep an eye on the temperature of the CPU.

Latency Adjustment

Once a suitable memory clock is found, latencies should be tweaked to maximise performance. If you are running a large memory clock and it appears to be unstable, loosen the latencies. To do this, increment the CAS value upwards. If the RAM is stable, lower this same value to tighten the latency.

The tRAS value can be determined via this simple equation:

$$tRAS = CAS + tRCD + 2$$

Stability Tuning

At this stage, you're either running your CPU at 4GHz, or you've hit a stability wall. Fortunately, if you fit into the latter category, there are ways to tweak stability.

Referring back to the voltages discussed previously, it's important to adjust these when appropriate. For instance, a large QPI clock will often require an increase of QPI PLL voltage to remain stable. Increase appropriate voltages until stability is restored.

If stability is still lacking, underclock the culprit component slightly and try again.

And that's it! Sit back, admire your efforts, and enjoy the fruits of your labour. You've just gotten your machine performing to the best of its silicon ability – 'gratz!' 

Alternate overclocking

The method used in this guide might be perfect for Core i7 920 chips, but if you have any other processor in the series it won't work anywhere near as well. Stick with the tried-and-tested method used by most overclockers; increase the BCLK speed (or multiplier if you've a 965/975) until unstable, then increase voltages until stability is reached. Continue alternating both BCLK and voltage until you're either happy, or have hit the maximum speed of the CPU determined by its refusal to go faster. This common method is easily applicable to all architectures; whether Core i7's BCLK, Core 2 Duo's FSB or Phenom II's HTT.

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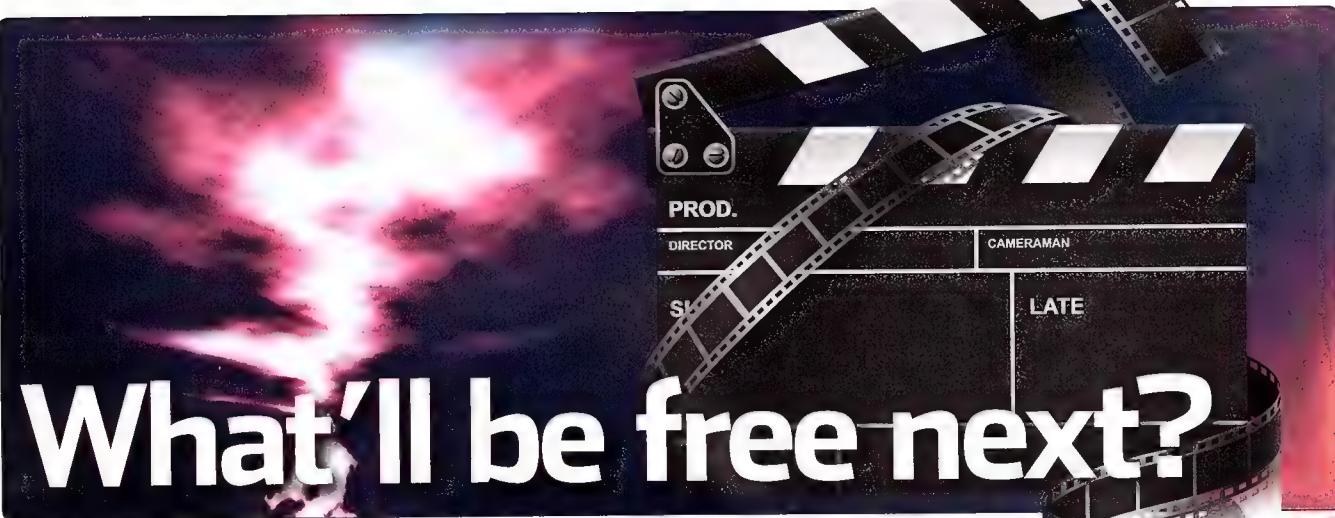
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What'll be free next?

Dan Rutter looks ahead to the future of free stuff online.

Before digital audio existed, there were plenty of musicians who wanted to give their music away for free. But there was no way for them to distribute it, without paying for duplication.

Now, it's easy for anybody with Internet access to grab a copy of arbitrary digital data from random Net-connected people on the other side of the planet.

Even if you ignore the petabytes of copyright infringement, there's still an astounding amount of free-to-download content on the net now. To a significant extent, music really has become free.

There are free books, too. Not a lot of them, I grant you; most writers guard their work ferociously, or are signed up with publishing companies that do the guarding for them. But there are others – I think, quite often, the better writers – who love the idea of being their own little digital lending library.

you needed expensive equipment, special premises, many functionaries and hangers-on – oh, and musicians, too. But now one person can create whole real-sounding orchestral works on their computer.

Live-action movies are still restricted by the same sorts of things that impeded music production a few decades ago. Digital effects and Pixar-grade 3D animation are getting better and better, but you still need a ton of processing power to do them. And if your movie is live-action, you need actors who can actually act, on top of all the support personnel.

I think inexpensive computers will, not terribly many years from now, bring to moviemaking what they've already brought to audio production. You'll be able to make a movie with a cast of thousands on a PC, designing actors with City-of-Heroes/Spore-like interfaces,

everybody involved is able to take time off work and still be able to pay the rent. Even little student films are major undertakings, by the standards of ordinary humans.

But it won't stay that way.

Will computerisation of movies make live actors obsolete? Well, movies and TV haven't made theatre obsolete, so I doubt it. I think it'll be more like the situation with drum machines. When they first became available people wailed (and some other people cheered) about how they'd make a whole class of musician obsolete – but now drum machines have become a perfectly valid instrument in their own right.

Hurry up, home-movie-studio developers. I can't be the only one with a burning need to give Battlestar Galactica a better ending. 

Personally, some of us think the ending is fine.
dan@atomicmpc.com.au

Even if you ignore the petabytes of copyright infringement, there's still an astounding amount of free-to-download content on the net now.

This leaves me wondering what's going to become free next.

I think it'll be movies.

On the face of it, this sounds ludicrous. Movies, after all, need actors and directors and sound people and camera people and focus pullers and grips and Best Boys and caterers and Assistants to Mister Impossible-To-Work-With Actor and drivers and animal wranglers and publicists and colorists and gaffers and set-builders and set dressers and hairstylists and makeup artists and continuity people and God-in-heaven it goes on and on and on.

But this is all because there isn't, yet, such a thing as a bedroom movie studio. The closest we've come is 'machinima', which is essentially a puppet-show.

If you wanted to produce a record in 1980,

animating them with as much or as little direct control of every twitch and quiver as you like, and setting up appearance and movement mutators to create crowds.

I wouldn't even be surprised if realistic close-up facial movement will be possible without motion-capture or puppetry, or if synthesised voices take over from voice talent. We've already got software that sings, after all.

Bedroom movie directors will even be able to set scenes in famous places. Microsoft's remarkable Photosynth can already stitch a bunch of photos into a 3D representation of a scene or object. Apply the same tech to freely-licensed tourist photos of a location, and presto, there's your location.

At the moment, it's impossible for a proper movie to be a complete labour of love, unless

KITLOG

These are our four basic systems, with something for every taste. On this page, the **Basic Game Box** is put together with money-saving in mind, but also an eye to getting as much bang for buck. It's the best value system for those who want a lot of processing grunt, but who don't want to sacrifice the upgradeability or compatibility that is so important. Intel's going to keep the P55 socket around for quite some time, so making the leap to this new platform is well-timed.

Intel's lowest-end Lynnfield CPU is no slouch in any area; overclockable over 4GHz, four hungry cores for multithreaded work and a pretty low heat output. The best part is the price, coming in at a level that you'd have to be silly to avoid.

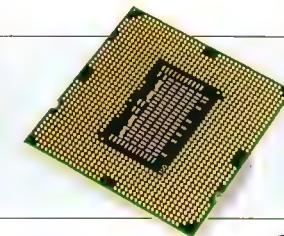


The Perfect PC, on the other hand, is the system everyone aspires to, with nothing but the best parts - without going crazy, though. It's a collection of all the greatest hardware that we'd pick without a budget, sure to impress with performance and sheer style.

Oh, and if you're wondering what the Ref IDs are, that's the ID of that article on our website. Just enter it like this – www.atomicmpc.com.au/?NUMBER – and you'll go straight to that review.

BASIC GAME BOX

CPU



Intel Core i5 750
PRICE \$270

Intel's budget quad is more than you'll need in a chip!
Issue 106, Page 36

MOTHERBOARD



GIGABYTE P55-UD4
PRICE \$225

A great value P55 board with some nice features..
Issue 106, Page 39

MEMORY



G.Skill Ripjaws 2000MHz
PRICE \$139

Great value memory with amazing overclocking.
Issue 106, Page 52

VIDEO CARD



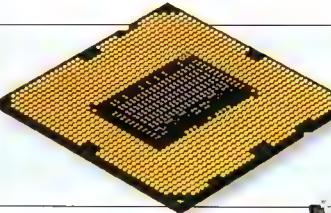
XFX 4770
PRICE \$175

Cheap doesn't mean slow; can play most games well.
Ref ID: 151293



THE PERFECT PC

CPU



Intel Core i7 870
PRICE \$850

The best enthusiast chip, evar.
Issue 105, Page 34

MOTHERBOARD



ASUS P7P55D Deluxe
PRICE \$440

Increase your performance, sex appeal and social standing!
Issue 105, Page 41

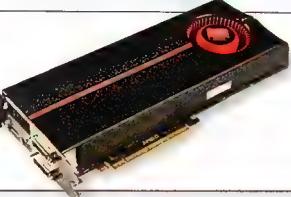
MEMORY



Corsair Dominator TR3X6G1866C7GTF
PRICE \$388

Plenty of memory, blisteringly fast and darn sexy.
Ref ID: 149838

VIDEO CARD



ATI 5870
PRICE \$550

The first DX11 card powers through all games.
Issue 106, Page 42

SUBTOTAL: \$1791

**Akwyn A1V8**

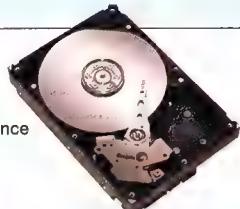
PRICE \$52

Performs well, incredible value, bloody awesome.
Issue 103, Page 47

640GB HDD

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Best price/storage/performance choice out there.

**AOC 2216Vw**

PRICE \$225

Great 22in widescreen for all your gaming needs.
Ref ID: 122168

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Solid set of cans with great audio.
Issue 101, Page 41

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A decent chip that does the job.

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Issue 105, Page 49

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**MOUSE****Verbatim Rapier V1**

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Great gaming performance and nifty features.
Issue 96, Page 43

POWER SUPPLY**Corsair TX-750**

PRICE \$199

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Ref ID: 107260

**Thermalright MUX-120**

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Not available yet, but a bloody good heatsink.
Issue 105, Page 34

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Patriot Torqx 128GB SSD

PRICE \$620

Lightning-fast speed for your OS; chuck a HDD in for storage.
Issue 103, Page 45

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Issue 48, Page 56

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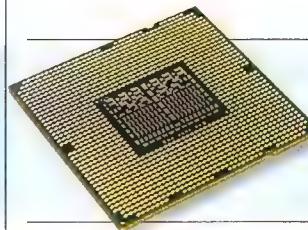
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The 5870 is our latest love affair, wooing our affections with its sheer performance and stealing our hearts with its hardcore tech specs. If 3200 shader units aren't enough of a reason, just wait for the 5870X2 – it'll have even more!



Finally, for the more entertainment-minded – and really, that's all of us – there's our **Home Theatre PC**, ready to play movies and music quietly and efficiently. It's got plenty of speed for video encoding while you're away, but makes very little noise thanks to the passive components used – even the heatsink can be dialed down to emit as much or as little noise as you want. Perfect for leaving next to the big-screen TV for all your media needs.

THE LAN BOX



Intel Core i7 920

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Intel's budget chip can rocket over 4GHz on air!
Issue 103, Page 36



MSI X58M

PRICE \$260

Teeny X58 mobo with heaps of value.
Issue 104, Page 58



G.Skill PC3-12800 C8 π Series

PRICE \$165

Six gigabytes of fast memory.
Issue 102, Page 45



ATI 4870

PRICE \$200

Sturdy performance, but temptingly low price.
Issue 92, Page 36

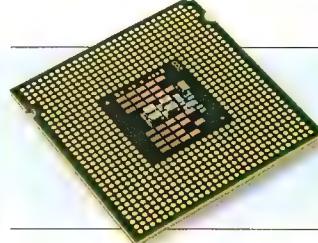
CPU

MOTHERBOARD

MEMORY

VIDEO CARD

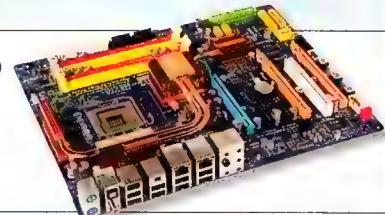
THE HTPC



Intel Core 2 Quad Q8400

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Quadcore to chew through video encoding.
Issue 103, Page 36



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CPU

MOTHERBOARD

MEMORY

VIDEO CARD



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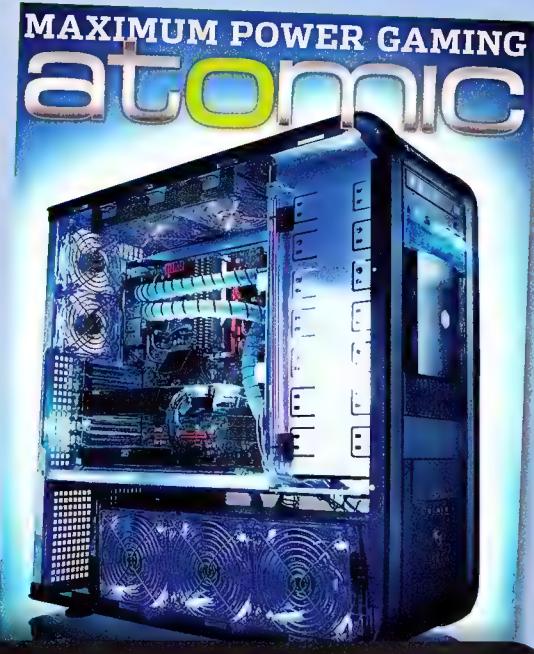
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TUTORIAL

HANDS-ON TUTORIALS FOR THE TECHNICALLY MINDED

As part of our super-special on building and tweaking the ultimate performance and gaming system, we're delving into the fine art of watercooling this issue. Air cooling is good, but only to a point – you'd get better clocks and less noise with a well-built water loop – and that's exactly what we're showing you how to build.

And not just a standard out of the box arrangement – this a system built from custom parts, based on the rig we put together in the feature

starting on page 24. It might seem daunting, but watercooling really is much easier than it looks, and it delivers the results.

And, you know... it looks pretty sexy, too!

Then we get all edumational with another Atomic.edu from Chris Taylor. This month he's been talking to the lads and lasses at the University of Melbourne. From what courses the uni offers, to what Melbourne offers to kids fresh from school, Chris gives us the full run-down.



KITLOG

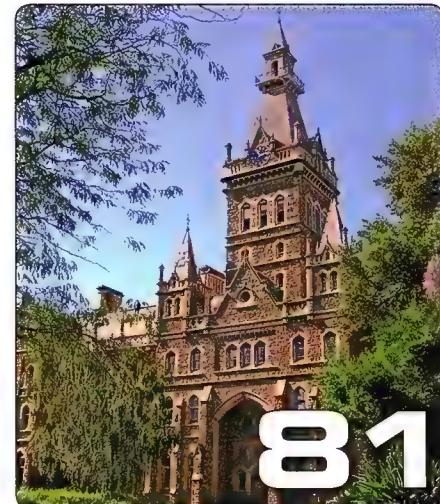
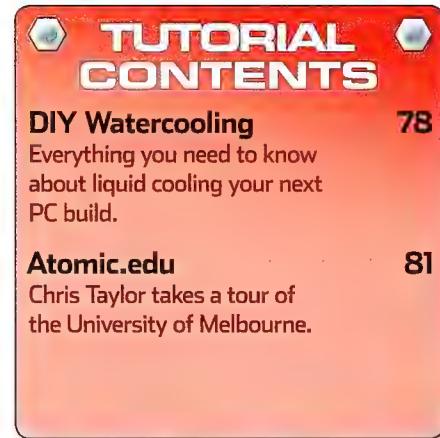
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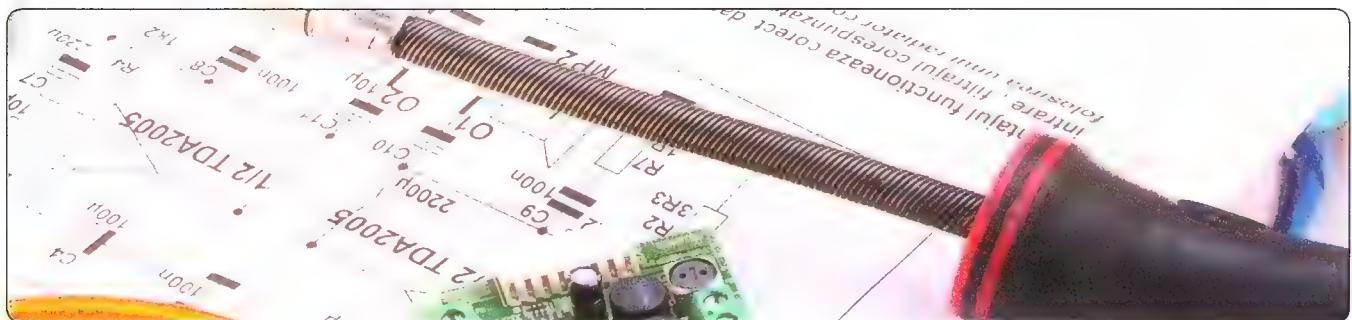
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Only available at
www.atomicmpc.com.au!



81



Watercooling

Water cooling offers many advantages - it tends to be quieter than air cooling, can cope with more heat and of course, it looks terrific. All that tubing puts many people off, though, so over the next few pages, **Mark Mackay** demystifies liquid cooling, and shows how to easily and quickly install a liquid-cooling loop

Once most PC builders start using water cooling, they never look back – and with good reason. It's usually a quieter, more effective way to cool your hardware and provides possibilities for a feast of visual splendour. As if all this isn't enough of an Aladdin's cave of modding delights, it also allows for greater overclockability. We're going to run you through the process of installing a basic loop.

A common reaction among people – even relatively hardcore PC enthusiasts – when they hear the words 'water-cooled PC' is a state of worry. Surely mixing water and PC components can't be a good idea? On the contrary, it's a damn fine idea. However, taking precautions against spillages is another good idea. For this reason, always have a roll or two of paper towel to hand. It's cheap, robust and absorbent – a trio of qualities that make it indispensable when building water-cooled PCs.

Aside from your kit, tools, paper towel and obligatory beverage of choice, you'll need a large clear area in which to work. Just as when building an air-cooled system, having a large desk to work on will make the whole process easier.

If you need to remove any parts of the case that might be inhibiting the installation of

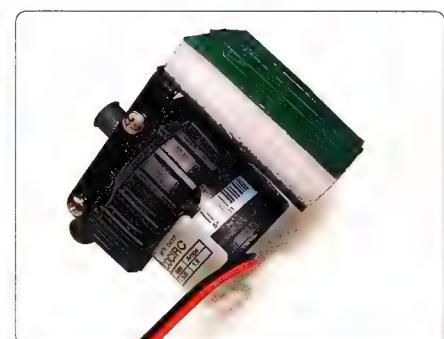
oversized radiators or reservoirs, now is the time to do so. In this particular build, all we had to do was take out the hard disk bays in the base of our SilverStone TJ07 case. If you need to remove hard disk bays to fit a radiator, there's plenty of kit out there that will turn a 5.25in bay into a 3.5in bay to house your storage.

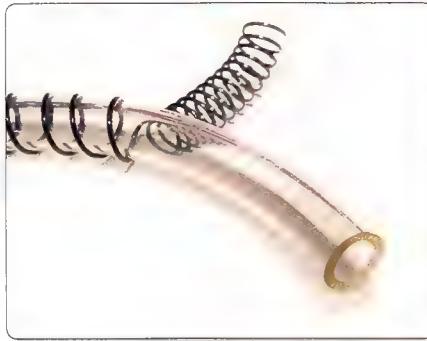
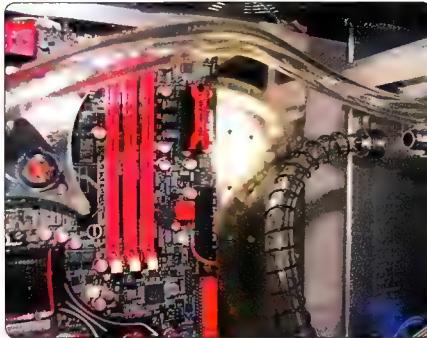
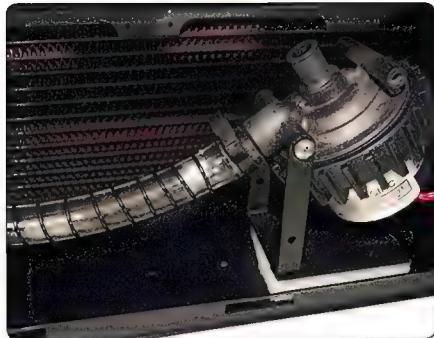
Our basic water-cooling loop will consist of a radiator (for cooling), a pump to circulate the liquid, a reservoir to hold excess water, waterblocks to cool the CPU and graphics card through which water is pumped, and tubing to keep it all connected. It's worth noting that

there's a huge amount of discussion about the installation of water-cooled systems; the following tutorial makes some assumptions about components and methods in order to present the instructions as clearly as possible.

Waterblocks

Prior to fitting the waterblock to the CPU, it's a good idea to first tightly screw barbs to your waterblocks. Barbs require some force to fit securely and the last thing you want is your pliers or spanner to slip and gouge your beautiful motherboard. The barbs are pronged connectors





over which the tubing passes in order to provide a tight fit when connecting to the waterblock. Different-sized barbs are used to enable the use of different-sized tubing, so you need to manually attach them.

Processor waterblocks usually connect to the motherboard using four spring-loaded screws. Much like installing a CPU cooler, you'll need to apply TIM evenly to your CPU prior to installation. Once that's done, follow the instructions in the manual to attach your block to the board using the bundled fittings.

Installing a GPU waterblock follows much the same process but it will void the warranty of most graphics cards, as you'll need to remove the stock cooler first. An easy way to avoid this is to buy a graphics card with a waterblock pre-installed.

Pump

The pump is the component that pushes the water around your loop. As it does this using an electrical motor, it's a good idea to use vibration-dampening foam underneath it, rather than have it come into direct contact with the chassis, as this will cause lots of vibrations. Pumps such as

the Liang D5 (pictured) are bundled with a foam layer but if your pump lacks this, you can make a DIY foam layer using strong double-sided adhesive and packaging foam.

Once you have your vibration dampening layer, you'll need to find a location for the pump. In the TJ07, behind the radiator at the bottom of the chassis is a good place. If you don't have such a space on your chassis, then the bottom of the 5.25in bays is another good location. However, anywhere that's large enough to accommodate it and allow the tubing to be connected is fine.

Reservoir

Reservoirs are available in all shapes and sizes. One of the easiest to install is a 5.25in bay model. These also have some aesthetic benefits, especially if you're using coloured dye, as you can see the liquid from the front of the chassis. If you don't want to have any liquid showing, you can also pick up models that have black brushed aluminium covers to blend in with cases such as the TJ07.

The reservoir has a cap on it that allows you to add water, but we'll talk more about the specifics later.



Radiator

You can install radiators in all kinds of ways. Many models simply screw into fan slots already present in cases. However, cases such as the SilverStone TJ07 have an ample cavity that can house whopping radiators such as the Thermo-chill PA120.3.

We used industrial-strength double-sided adhesive to secure the radiator – and lots of it. It's available for a few dollars per roll at many hardware outlets. Apply an even layer to the underside of the radiator, covering every inch.

Think about where the radiator needs to go before attaching the tape to the base of the case. Once this is applied, it's going to be a serious job to get it off again, so take your time and get it lined up straight and true.

Direction of flow

There's a lot of contention surrounding the subject of flow direction in loops. We believe that the ideal order is to situate the CPU directly after the radiator (where the liquid is cooled) to ensure that it receives the coolest water in the loop. A golden rule, however, is to place the pump immediately after the reservoir – this keeps the flow rate high, as the pump will always have a supply of airless liquid to push around the loop.

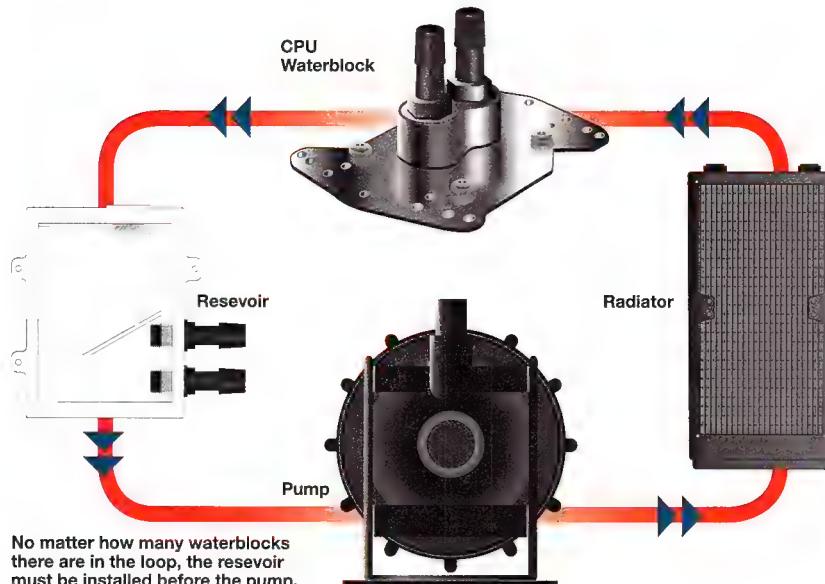
Aside from this, make sure there aren't any kinks or sharp bends in the loop. Where sharp bends are inevitable, use plenty of smart coils to maximise the flow and minimise risk of kinking.

Connecting the tubing

Once all your hardware is in place and barbed up, it's time to connect the tubing. Sometimes, you may have tubing that's too tight to fit over a barb. If this is the case, simply dip the end in some hot water before coaxing it over the end.

When one end is held in place on a barb, measure the tubing up to the barb to which it's to be connected next. Cut the tube neatly at 90 degrees across the plastic, and at the correct length with a strong pair of scissors or a sharp Stanley knife. Mind your fingers. Allow a little slack in the tubing; you don't want it to take it in a tight, straight line between components, as this will place strain on the connectors, and over time, pull them off. This is especially important for tubing to be connected to a 5.25in bay reservoir, as you'll need to pull it slightly out of the front of the chassis to fill the loop later.





Once you have the right length, you can wrap the smart coils around it. Doing this is as easy as winding them around the tubes. The coils will make the tubing easier to manipulate and prevent it from kinking, which of course, will impede the flow of liquid. When the coils are on, fit the bolt parts of the compression fittings over the tube and attach the ends to the barbs. Finally, tighten the fittings as much as possible, using your hands. You can also use pliers for the job, but they aren't essential and can damage the shiny finish of the fittings. If your hand doesn't feel strong enough, call on somebody with stronger hands for assistance.

Filling the loop

Before filling the loop with water, you need to test for leaks and this means making sure that as few components as possible will receive power when you switch on the PSU. Remove the power cables from everything inside the PC bar the pump; otherwise simply connect the pump to your PSU. The reason for doing this is so that if there are any leaks, or if you spill water when pouring it in, you won't damage your PC. If any water does spill, don't panic; switch off the power, remove any excess water with a paper towel and leave it to dry before starting again.

As PSUs are traditionally powered up by a signal from the motherboard, you need to trick the PSU into powering up another way. Making sure that the PSU isn't plugged into the mains, you need to use (or make) a PSU jump-start cable – a flashy term for a U-shaped piece of wire that will be inserted into the black and green pins in the 24-pin ATX connector of your PSU. Some water-cooling kits include a jump-start cable, but at a pinch, a paper clip will suffice – just make sure you don't touch the metal with your fingers. Alternately, you can use needle-nose pliers instead.

While pumps don't like running dry, since the components and tubing are full of air, you can't force water into the loop, as it will simply bubble out. This is where a reservoir comes into its own.

Hold it higher than all the other components in the loop and you can fill it with water to keep the pump busy as you prime the system.

Priming is the process by which you continue to gradually add more water as you switch on the pump. The trick is to pour enough water into the loop so that the pump won't get damaged by running dry. There's no hard and fast rule for this stage – it depends on the configuration of the loop, the size and positioning of the reservoir, and how powerful the pump is. If everything is going well, the pump should suck water through the loop, so you need to be on your toes and ready to top off the reservoir to prevent the pump from running dry.

Once the loop is up and running, keep the reservoir topped up to about three-quarters of its full capacity and check for leaks. Although a

major leak will be obvious, it's worth taking the time to check every connection and component in turn, running your finger or a dry paper towel around each in turn. Even if everything appears to be watertight, it's still a good idea to leave the system running for several hours, as a hairline crack in a component might take a while to leak a visible amount of water. If you want to play it extra safe, leave the system running overnight.

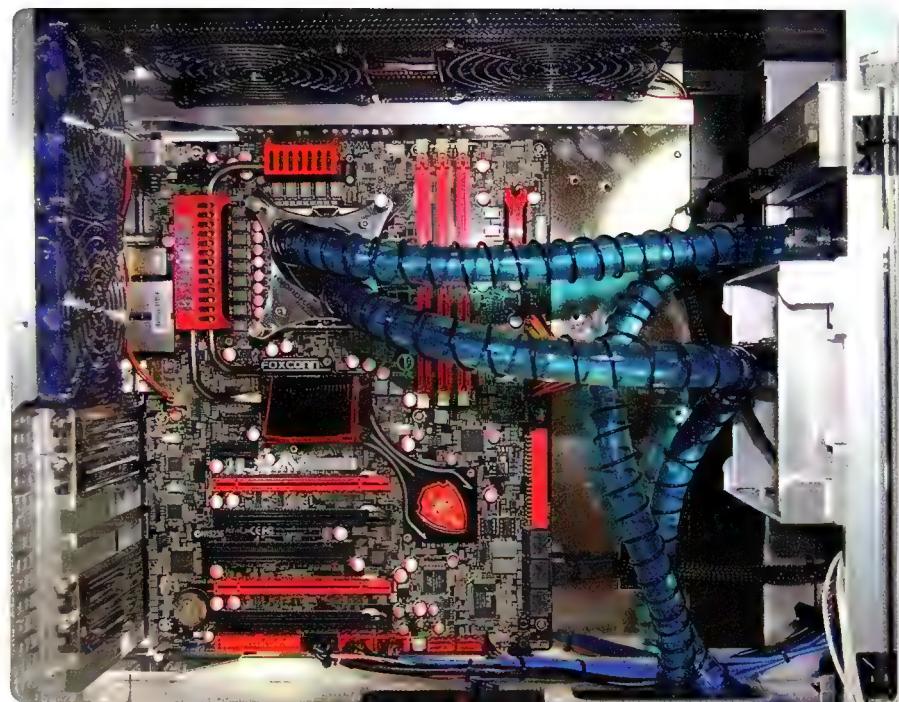
Bleeding

This isn't as sanguinary as it sounds – bleeding in this context requires no leeches. Instead, it's the process by which you try to remove as much excess air as possible from the loop. This air needs to be removed, since air bubbles will reduce the performance of the waterblocks and radiator – you want them to be full of water to conduct heat. Bubbles also create noise as they pass through the pump.

It's a good idea to check all the tubes and wiggle them if any large air bubbles have become stuck. Next, you need to try to remove as much air as possible from the individual components. Make sure that the reservoir's filler cap is securely fastened, then give the whole PC a good shake. You aren't auditioning for a steel band – you're simply trying to loosen any air bubbles that may have formed inside the waterblocks and radiator. As long as the reservoir isn't filled to the brim, and is the highest component in the system, any air bubbles you shake loose will become trapped inside and won't circulate back into the loop.

Once this process is complete, you may need to top off the reservoir with a little extra water, depending on how much air was trapped in the loop, before finally securing the T-line/reservoir in its final location in the case.

Congratulations on installing your first loop!



University of Melbourne



Chris Taylor looks into the University of Melbourne's new 'Melbourne Model'.

A couple of weeks ago I was taken on a tour of the University of Melbourne by Alistair Moffat, head of the Department of Computer Science and Software Engineering. Moffat was keen to explain the revisions made to the University's information technology offerings since the introduction of the Melbourne Model.

The University of Melbourne is located in Parkville, a short distance from the Melbourne CBD. The campus, which sprawls across a number of blocks, is accessible by tram and bus. The Department of Computer Science and Software Engineering's facilities are modern and well equipped with computer labs.

Undergraduate studies

The introduction of the Melbourne Model has not come without criticism, but nothing we saw suggested it had been a change for the negative. Essentially, the Model's aim is to add breadth to the University's courses. For information technology students, what this means is all first year Bachelor-level students complete the same units. Only in the second and third years of their study do they move down a specialist path.

As part of the Melbourne Model, the old courses, which included a Bachelor of Computer Science and Bachelor of Information Systems, have been reworked as specialisations of the Bachelor of Science. Until recently, Software Engineering was part of the Bachelor of Engineering. Semester 1, 2010 will be the final intake for the old Bachelor. As of 2010, Software Engineering will fall under the banner of the Bachelor of Science.

In effect, Students who study information technology at undergraduate level at Melbourne University will now walk away with a Bachelor of Science majoring in Computer Science, Science Informatics or Software Engineering.

The Computer Science and Software Engineering majors are self-explanatory. Science Informatics, on the other hand, brings together aspects of computer science and information systems. As the 'science' in the name suggests, the Science Informatics major is designed primarily for those seeking employment in scientific fields such as chemistry, geology and medicine. Detailed information on each of the specialisations that can be undertaken by Bachelor of Science students is available on the University of Melbourne's website (www.bsc.unimelb.edu.au/bachelor/study).

For Victorian students, the entrance requirements for the Bachelor of Science are pretty much what you would expect: a study score of 25 or more in any English subject (or 30 in ESL), 25 in Mathematical Methods and 25 in Biology, Chemistry or Physics. Interstate students inter-

ested in studying at the University of Melbourne require equivalent scores in equivalent subjects. As a guide for interstate students, Mathematical Methods is the mid-level mathematics offering at VCE. Entry requirements for mature age (23+) applicants vary depending on what tertiary studies, if any, the applicant has completed in the past.

Moffat told me the Department of Computer Science and Software Engineering runs an annual 'industry night', during which students can show off their work to family, friends and representatives from the information technology industry. The Department requires students to work in groups to design and implement software in simulated real world conditions. Given the never-ending criticism from employers about the competence of information technology

graduates, the University of Melbourne's emphasis on 'real' is good.

Beginning university

If you're fresh out of secondary school or returning to study after many years in the workforce, starting university is an intimidating experience. Since the inception of atomic.edu we've constantly reiterated the point that success at university demands motivation and discipline. You have classes, assigned readings and major assignments, but ultimately your learning is self-guided. You get out no more than what you put in.

The University of Melbourne, like all good institutes, does what it can to ease you into the experience. Each faculty has its own student centre. The University offers various channels of support. Various scholarships are available





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and are awarded on the grounds of academic merit and disadvantageous circumstances. If you're coming to the University from overseas, interstate or rural Victoria, accommodation is available around the Parkville area.

During our chat, Moffat spoke of the University's emphasis on research and theory. Graduates of the University, he said, enter the workforce with a solid understanding of the principles behind the software. It is not the objective of the University to teach students how to use specific applications, as most likely those applications will be superseded by the time the students finish their studies. There is nothing about this approach that is unique to the University of Melbourne. You attend university to develop foundational knowledge and 'learn how to think', not to learn the ins-and-outs of the latest edition of Microsoft's Visual Studio suite.

From my own experience as a student at the University of Melbourne, I can say with confidence that the University's collection of resources is extensive and of high quality. Again we must reiterate the point we raise so often in this column: universities offer you everything you need to succeed except the motivation and discipline.

Research and graduate study

The University of Melbourne has a reputation, both in Australia and overseas, for being involved

in significant research projects. There are a lot of research students currently working on projects. In the past, organisations such as Google, Microsoft and Yahoo! have provided the University with funding for this research.

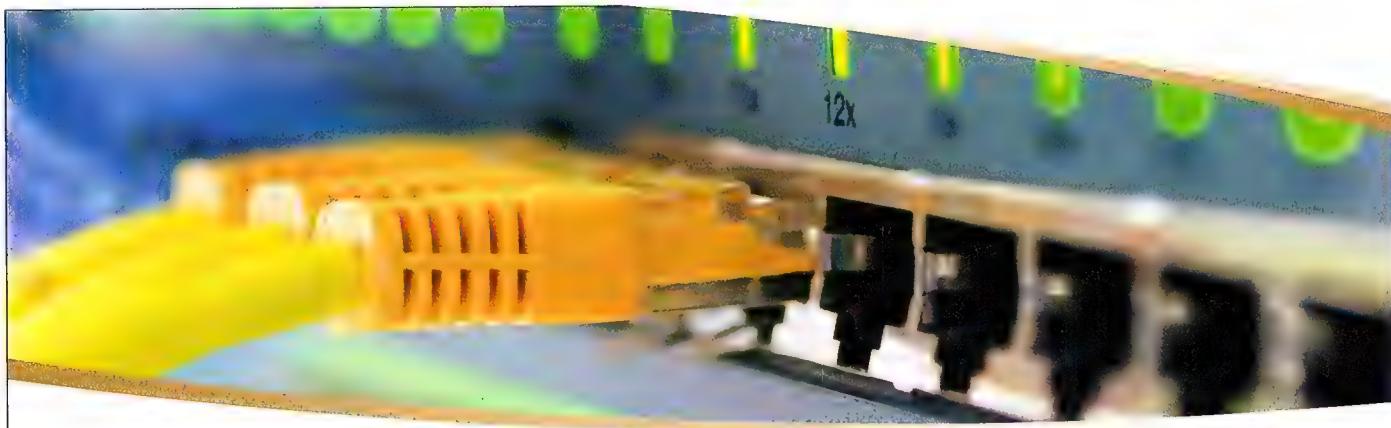
During my visit, Moffat was keen to talk about some of the projects staff and graduate students are currently working on. He mentioned the efforts of students working with grid computing, constraint programming, data mining and information retrieval. We were familiar with two projects he discussed. One of these projects involves graduate students travelling abroad – Moffat mentioned a student who visited tribesmen in Papua New Guinea – and recording languages at risk of being lost due to their lacking a critical mass of speakers and having no written form. The goal is to develop a deep understanding of how humans communicate. Moffat raised the possibility of one day developing software capable of accurately translating between lost languages and commonly spoken and written languages.

The other project Moffat discussed in detail was an advanced surgery simulator, designed to train medical students in different surgical techniques. Moffat showed me the simulator and introduced me to some of the team currently working on it. One team member explained that the simulator isn't designed to replace cadavers, but to provide students with surgical experience before they work on cadavers. The software can simulate different surgeries in as broad a range of patients as

surgeons would encounter in the real world, such as those with anatomical abnormalities. Zooming in on a virtual temporal bone and feeling the bone's resistance to the drill through the custom-built force feedback input device was probably more entertaining than it should have been.

The University of Melbourne offers a wide range of graduate degrees, including the Master of Information Systems (www.dis.unimelb.edu.au/postgrad/mis) and Master of Information Technology (grad_mit.html).

As of 2010, the Master of Engineering, a new graduate degree will be available. Specialisations available to students of the Master of Engineering include Mechatronics and Software Engineering. The duration ranges from 1.5 to 6 years, depending on your previous studies, chosen specialisation and workload (i.e. whether you pursue full-time or part-time study). The entry requirements for the Master of Engineering are the successful completion of two university-level science subjects relevant to your chosen specialisation, as well as the successful completion of university-level Calculus and Linear Algebra subjects. If your first degree fell under the banner of engineering, you are eligible for recognition of prior learning in Master of Engineering units that cover the same material you covered in your original course. More information on the Master of Engineering is available on the University of Melbourne's website (www.eng.unimelb.edu.au). 



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GAMEPLAY

GAMES, GAMING AND FILM COVERED... ATOMIC-STYLE

There's just so much awesome gaming to be had in the last few months of the year that we are in serious danger of contracting Controller Cramp, Mouse Malaria or Keyboard... something that starts with a 'K'.

Already, the hits (and a few duds) are really starting to come thick and fast. We've gone toe-to-toe with the Joker in Batman: Arkham

Asylum, donned cape and undies in Champions Online, and fallen madly in love with the depth of Scribblenauts.

Seamus Byrne also goes in depth with the folks behind the upcoming BioShock 2, and Liz Skuthorpe sits down with the devs at Blizzard for an in-depth chat about the new Warcraft expansion, Cataclysm. So get gaming!

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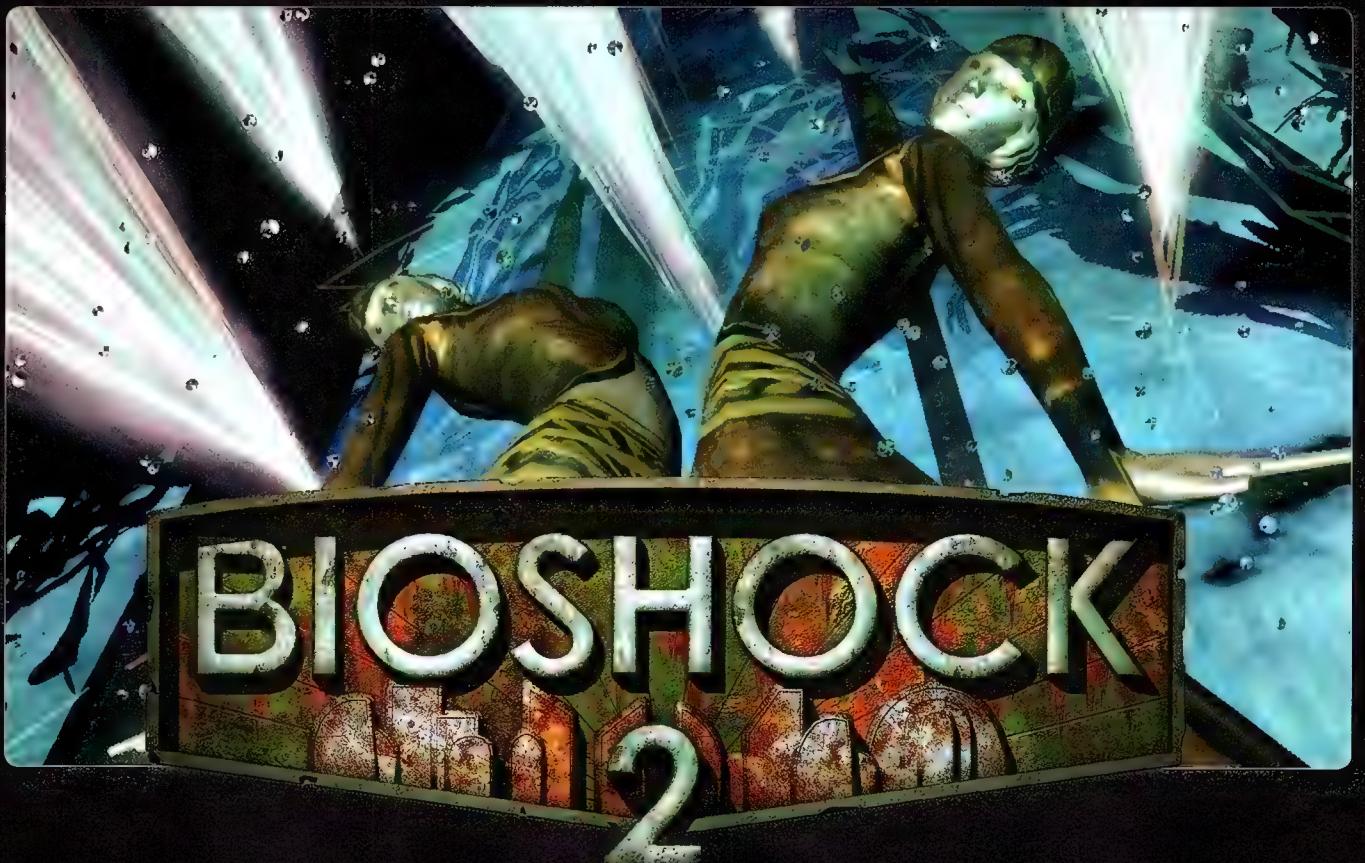
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Who's your Big Daddy? You are, says Seamus Byrne!

Godfather II. It's one of those rare sequels that actually surpassed what was an already powerful original. When 2K developers started work on a sequel to their 2007 hit Bioshock, you can only assume Godfather was more than a passing thought as they strove to build us something that would not disappoint. But for every Godfather II there's a Weekend at Bernie's 2. (What, you don't rate the original?)

What made Bioshock special was an intelligent style and setting for a very creepy shooter. A game that asked players questions about agency and free will, a clever story that ultimately reflected the player's own experience — do you really get to choose anything when the game designer is leading you to a narrow set of outcomes?

So how do you push beyond the experience of being 'Jack' and take Bioshock and the world of Rapture into uncharted territory?

Senior Designer at 2K Australia, Dean Tate, tells us that we're in for more than your average sequel for more than a few reasons.

"BioShock 2's single player experience isn't set during the same time period as the first game. We're doing some things with the time line that are a little more interesting than following the pure 'sequel/prequel' route," says Tate. "Going into that in detail would spoil the experience."

Then there's another shift. This time out you're a Big Daddy. But not just any Big D. The original

Big Daddy. We asked Tate how scared Jack should be if he was facing off against our new protagonist.

"Jack would have no chance against the player's Big Daddy in BioShock 2. I doubt that even a Vita Chamber would help (except in maybe reconstituting a slobbery pile of Jack meat-stuffs); you are the original Big Daddy, and easily the toughest ever built. You're the result of an extremely successful experiment into just how far the power of ADAM can be taken. And

you are the original prototype, the base used to build all other Big Daddies, and the only one of your kind that retains freedom of thought."

And, naturally, that's where things get very interesting.

"You were a little too much of a success," Tate continues. "For the most part, the 'features' that you possess were scaled back a little when Big Daddies went into mass production. Because of that, you are unique; you're able to splice to utilise new Plasmids and Tonics, including some





that probably would have burst Jack's fragile little head. You can wield these powers alongside your more standard physical weapons. You're not a slowly lumbering buffoon like those later models; you're fast. Basically, most remaining citizens of Rapture absolutely fear you (I said 'most'). The citizens of Rapture have evolved over time, and some of them are ready for you.)

The power, The POWER!

"In my opinion, the combat in BioShock 2 has improved 200 per cent over what we had in the original game. This is the shooter we'd always wanted to make. I'm STILL finding new tactics to use," says Tate. "We've added depth and complexity in every area, most of which comes through in our improved Plasmid system."

Tate admits that Plasmid upgrades that just gave 'more power' got a bit boring the first time around. So this time Plasmids are getting much more creative.

"There will be new ways to splice (and I won't spoil). But maybe even more exciting than new Plasmids are the new effects that old Plasmids will have on your character. Upgrading your Plasmids won't just give you more power anymore. This time around you'll unlock fantastic new ways to use your old Plasmids," says Tate. "My favourite is combining Cyclone Trap with Winter Blast to make a swirling vortex of cold; watching a Splicer wander into the vortex, snap freeze into a block of ice, and then get sprung into the ceiling and shatter into a million pieces will never, ever, ever get old."

As a Big Daddy, you'll also be given the opportunity to work with Little Sisters, too. You can harvest them like a heartless beast, or you



can adopt them and protect them as they suck the ADAM from the marrow of your fallen foes.

For the hardcore shooter fan, the spam-die-Vita Chamber-rinse-repeat cycle of fighting tough enemies was a real turn off. But Tate also feels confident they've found some solutions to stemming the abuse of this magical 'circle of life'.

"We're doing some stuff under the hood to address this issue, and feel like we've successfully mitigated the chances of this sort of thing happening," he says. "And as in the PS3 version of the game, those players that don't like the Vita Chambers will have the chance to switch them off."



With great power comes great... enemies

Now before you go diving straight for the Vita Chamber off-switch, Mr Fancypants, you might want to pay attention to what you're up against. It seems one of those Little Sisters from the first outing has grown up a bit funny in the head (you mean, they didn't all end up weird?) and has turned herself into the ultimate weapon. This Big Sister is now running Rapture, and she will take down anyone who messes with the not-quite-perfection-but-order-none-the-less she has brought back to the city.

Funnily enough, you're not one for leaving things well enough alone. And the Big Sister will come looking for you. You will get some warning of her approach, and in the creepiest fashion possible if you have a Little Sister around at the time — she'll sing a cutesy little song about how Big Sister doesn't want you playing with her. Are we the only ones getting weird Freddy Krueger flashbacks?

Under the sea

We've heard stories and seen footage of some interesting sections of the game that send you out into open water. While much of the game is a closely guarded secret, Tate was able to let us in on a little bit more of the kind of play you will find when you're outside the city itself. And this sounds like an area you'll be able to take things a little slower than elsewhere.

"We're allowing people to view Rapture from a new perspective with underwater travel. These spaces will allow people to (ironically) take a breath, take in the sights, and explore," says Tate. "Inquisitive players will be rewarded for being thorough, with various rewards to be found; the sea slugs that naturally produce ADAM, for example, may be lurking in the coral and seaweed."

... she can mainline ADAM from victims to fuel her powers on the run.

Your Big Daddy might be in a different league to the slow lumbering tanks we remember, but the Big Sister is an entirely different breed altogether. Both very fast and powerful, she can also mainline ADAM from victims to fuel her powers on the run.

The gears that keep Rapture turning

One developers' dilemma on building a sequel is deciding how many wheels you should reinvent. Do you leave the engine as is, make a few tweaks, update art assets, and focus on new experiences? Or do you rebuild the system itself as part of giving players something new to look forward to? Naturally the truth lies somewhere in between, but where to strike the balance is an important part of the sequel gambit.

Mathi Nagarajan, a member of the programming team at 2K Australia since the

days of Freedom Force, saw plenty of hard-won lessons from BioShock that could quickly be put to work in the sequel.

"Part of what gives BioShock 1 its unique look and feel is the rendering techniques and algorithms that we used and we didn't want to make BioShock 2 feel like a different game."

"When making BioShock 1, we learnt several lessons about how to utilise memory for art and AI assets for our engine, but we never had the

time to deploy those *during* BioShock 1," says Nagarajan. "For BioShock 2, we've been able to apply this knowledge and adapt the engine to use these newly authored assets. This means that we can have extra geometry and complexity in each level."

Nagarajan also points out they have added tools to allow for more atmospheric environments, like volumetric fog. This also offers faster transparency rendering, which in turn allows for more particle effects and the use of more complicated materials.

"On top of that, we've also added some motion blur to convey the speed of some of the faster characters," he says. "We've been able to add these new effects without impacting the frame-rate by optimising existing shaders and rendering techniques."

In the end, suggests Nagarajan, it's all about expanding the creative freedom of the artistic team.





"We've taken the engine that served us well for BioShock 1, and we've really pushed it to its limits. The engine has been significantly optimised for both memory and performance and with the new features and tweaks, you should see more diversity in artistic expression, more complex areas featuring bigger battles as well as more Splicer variants and other inhabitants of Rapture. This should give fans of BioShock plenty to look forward to."

How to make friends and kill people in Rapture

Adding multiplayer to a successful, and very powerful, single player experience is its own risk, but hitting the multiplayer jackpot is worth its weight in ADAM. And right out of the gate we have a very interesting proposition. Instead of somehow shoehorning multiplayer into the world

of BioShock 2, we are instead offered access to the time when everything went pear-shaped in this undersea utopia.

"BioShock 2 Multiplayer is unique in that we feel it's given us the chance to tell the story of another part of Rapture's history," says Tate. "Multiplayer will focus on Rapture's earlier history, the time of the civil war that lead to Rapture being in the dilapidated state people know from BioShock 1."

"This is back when people were just beginning to splice, and there was an ADAM arms race

raging between Ryan Industries and Fontaine Futuristics. So Multiplayer is about filling in some of those gaps, questions people have about why Rapture went from being a sprawling art-deco paradise to 'the unhappiest place under the sea', as I like to call it."

After a disappointing delay it's good we can now start ticking off the days until 9th February rolls around so we can dive back into the depths of Rapture — whether as Big Daddy, or as some kind of messed up Splicer looking to party like its 1959. 



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MODIFICATION

with Ashton 'I ain't 'fraid no mod' Mills



Cinematic Mod

Game Half Life 2

URL www.cinematicmod.com

What can we say about the Cinematic Mod? Since a picture is worth a thousand words, and we're tight on space here, look at the screenshots on this page.

Done looking? Indeed. Now you know why you wear undies. Of course, such graphical majesty does not come cheap. The Cinematic Mod is so titled for a reason, and comes with the following requirements: 64-bit Windows, 4GB of memory, a fast CPU and at least 9GB of your download cap. It can run on 32-bit Windows, as a 'lite' version, but seriously if you're going to install a mod like this you want the whole hog, so you're going to need take advantage of that 64-bitness in your CPU.

While not explicitly stated on the homepage or forums, it goes without saying that fast cards with lots of onboard memory (especially onboard memory, preferably 1GB) will fare far better than lower-end cards. In order to properly utilise system memory, the mod comes with its own launchers that pass switches to Half Life to utilise larger heapsizes.

Once installed, it makes a tremendous difference. You will ogle and drool over Half Life 2 just like the first time you played it, only now you can enjoy it all over again with a full-on facelift. The mod covers all of Half Life 2, Episode 1, and Episode 2 so you can play the whole series in cinematic glory. It's not just new textures, either –





new models, environments, and sound tracks complement the experience.

The mod has been in development for many years, and has hit various milestones over this time. Version 10 is nearing completion, but if you don't want to wait around you can grab the

Cinematic Mod 9.5 right now. Note that there are no download links from the homepage for obvious reasons (the author, FakeFactory, would have immense bandwidth bills) instead head to the forums to find download links as individual files from Rapidshare or better, a torrent link.

TRINE

Mod Ultra High Quality

URL www.filefront.com/13942717/UH_all_V2-Trine.zip

This one is special secret sauce. Special, because it's for the indie-made beautiful side-scrolling platformer TRINE; and secret because it's not publicised, in fact there isn't an official download or homepage for the mod. It's currently hosted at FileFront, so grab it while you can.

It's also in German. So you need to speak German. Or learn German. Or ask a hot German girl to set it up for you ("rawr"). Or you could just wing it – it's actually not that hard.

The Ultra High Quality TRINE mod extends and expands the in-game graphics settings to include higher levels of resolution, anisotropy, antialiasing, particle effects, physics detail, and a lot more.

Because TRINE's ini setting files are tied to the menus, the author has included the locale directory (in German) necessary to toggle the extended options from the menus. However,

if you don't have a German friend handy, all you need to do is browse the bundled 'default_game_options.txt' and 'launcher.txt' files from the mod, and copy the relevant parts to the files of the same name in the 'data/misc' directory of your TRINE install (yes, even if you purchased off STEAM).

It will take you maybe 15 minutes, but by comparing the Ultra High ini files versus your vanilla ones, you'll quickly see which sections have been extended. You won't be able to toggle options from the menus (your English menus won't be mapped to the new options) but TRINE isn't exactly a demanding game (although the mod does let you run it at 3360 x 2100!), so you can just paste the highest values as your 'default' settings and the game will load and use them.

PATCH notes

The month's essential patches.



Need for Speed SHIFT Patch v1.00

World of Warcraft Patch v3.2.0a to v3.2.2

Call of Juarez: Bound in Blood Patch v1.1

Call of Duty: World at War Mod Tools v1.4

Call of Duty: World at War Map Pack 3 Patch v1.5 to v1.6

Aion v1.5.0.1 to v1.5.0.5 Patch

ArmA 2 Patch v1.04

Battlefield 2 Alt-Tab Hotfix Patch for v1.50

Third Age: Total War Mod Patch v1.1b to v1.2

Warcraft 3: The Frozen Throne Patch v1.24b

Warcraft 3 Patch v1.24b

Mass Effect Patch v1.02

Goldeneye: Source Patch v3.1 Beta

Warhammer Online Pre-Patch v1.3.1





INTERVIEW

World of Warcraft: Cataclysm

Liz Skuthorpe stuck around after Blizzcon last month for an exclusive interview with Blizzard's **Tom Chilton** and **Cory Stockton**. Here's the awesomeness that followed...

All of Azeroth is changing; will level cap characters have quests to let them explore the remade zones?

TC: I would say that a lot of what's going to be bringing people back is the new race/class combinations. You know, a lot of people may not currently have that reason to reroll, there are people out there that may have always wished they could be a blood elf warrior or a dwarf mage or whatever. And so once that opportunity becomes available it makes sense to do that again. **CS:** I think heirloom items also bring that up and that's one of the reasons we wanted to push the concept of the guild progression heirlooms. So, if someone wants to re-roll and come back they can feel like they've got a really cool bonus – those three or four slots will be full and they'll get a bonus all the way while they're leveling up. So that will help them and maybe encourage them to try something new.

And there'll be more heirloom items coming?

CS: Yeah, we'd like to fill out a couple more slots than we have now, but we've kept the heirlooms pretty small, it's a system we want to be careful with. You don't want to get too many in, 'cause then people won't take any other items.

TC: Yeah, characters would be set for the entire time!

CS: Yeah! There are still some things we want you guys to do, but we're definitely going to expand on it.



Levelling has sped up recently, how will that affect the new zones?

TC: I wouldn't say so. If you take for example the Recruit a Friend program that allows you to level up at triple speed... we already know that





while that is really fast the game-play experience doesn't totally break down. So we feel like there is a lot of room for play in there without having a break.

CS: Because the maximum you can get now without Recruit a Friend is a 20 per cent bonus if you're wearing the two heirloom items. We're looking at that right now as being the maximum, as we're re-flowing the zones. If we feel like an area is slow we can add in more quests or they give more XP, so you know, we can change things up and we have that opportunity now that we're re-flowing everything to make sure.

And also I think you have to take into account that they'll have to go through Outland and Northrend as well. With each expansion we'll be adding more and I think we'll be okay with that as we slowly make that experience a little quicker. But I think the key issue is that it doesn't feel broken. We still want quests to be 'yellow' and if you get a 'red' quest think 'No, I should wait'.

So I think the mount changes in patch 3.2 were a cool way to make things feel quicker but didn't change the XP curve at all.

TC: Some places where I would expect a change to the XP curve would be in 70 to 80 areas.

Moving onto instances, what can you tell us about the new heroics like Deadmunes?

CS: Well the concept behind this is that we want to keep the locations the same, the art will remain the way it is now. But we'll change the fights and we'll change the encounters that you do in between – so the pulls and the flow will feel a little different. Deadmunes is a pretty long instance and there's the non-instanced section at the beginning, so our goal is to make it feel more like a level 80 dungeon.

So, whittled down to about 45 minutes?

CS: Yeah, we shoot for about 45 minutes. We'll

update the loot and we'll add new achievements. So it should really feel like one of the new Cataclysm dungeons, but something that people are used to, have some nostalgia for it.

TC: So much of the speed of going through instances is based on the different pulls and encounters and the way that we spawn it. It actually has less to do with the actual physical size of it.

But we'll still be seeing the same bosses? Mr Smite will still daze us?

CS: Oh sure, you'll still fight Van Cleef, Mr Smite.

TC: Oh yeah, you'll see Cookie up there, they'll all be updated.

CS: There might be new mechanics for Van Cleef, for example

TC: Van Cleef might not just have two stealthed buddies, you might get waves running in or whatever.

CS: We went to a lot of trouble to pick which ones to update – we knew we wanted to do two of them, but there are a lot of dungeons to choose from. Scarlet Monastery was one...

Are there plans for more?

CS: It's left open, and it's something that we've talked about doing in patches before this but it always got bumped to the end of the list. Whereas here I think we felt like it was the time because we are going back and it fit really well here.

TC: But we don't want to do it too much; to the point where we're just updating old content. In Cataclysm, with the exception of Deadmunes and Shadowfang Keep, everything else is a new instance, completely new bosses. There are more new bosses than there ever have been in an expansion before. We don't want people to get the impression that we're just taking everything and bumping it up to level 85 and calling it a day.

CS: And those two, if you compare it to our Northrend lineup, are in addition. We always consider whether it feels like there are enough dungeons, or do we want to add more. But those two things, in the grand scheme it doesn't take a ton of time. Re-working Onyxia wasn't a lot of time for us, but we wanted to do something special for the players.

For more of this great interview, check at Atomic online, at www.atomicmpc.com.au/?157032, in the PC games section! 





Borderlands

Can a cell-shaded, RPG/shooter hybrid be a contender for game of the year? You bet...



There've been a lot of games over the last little while that have promised gold, but delivered a tarnished silver at best. Borderlands, on the other hand, has been quietly plugging away (that is, if any game with Randy Pitchford at the helm can be considered to be 'quiet') for the last few years, letting the quality of its art and the premise of its seamless hybridisation of the RPG with FPS pretensions speak for itself.

And we've been listening, intently, waiting for the chance to get some quality alone time with this intriguing title. We finally have, now, and this is one game that delivers a lot more than its wildest promises.

We've covered the premise of Borderlands in a recent Engine Room, but for the casual reader, here's the Cliff's Notes. The planet Pandora is a more or less failed colony, marked only for the viciousness of its native wildlife, and the stubbornness/viciousness of its surviving colonists/mad roaming land pirates. Cue one of four adventurers looking for lost alien treasure, and you've pretty much got Borderlands nailed down. It's a simple tale, but the depth of the game comes in the execution, and that's evident from the game's rolling credits, a flavoursome narrative introduction to the four characters you can choose to play delivered in a staccato Mexican accent and backed by alternative

country rock, travelling in a rusty bus.

Oh, and they run over a dog-thing, too. Edgy!

Cell-shaded win

But it's a very cool kind of edgy, not that hyper-ironic-but-stupid kind. A lot of that awesome feel comes from the game's artistic style, which is basically cell-shading on crack. During a recent hands on, we got to chat with Gearbox's

Randy Pitchford, and we think he says it best. "Everyone's used to HD quality textures now, so no one really notices them any more. But you wander around Borderlands, and you're constantly going 'Wow, this looks awesome!'"

This is because, on top of the cell-shading, there are actual brush and pen strokes on the characters and the landscape. You might not think this would work, but it really does – it's a very striking and, more importantly, unique visual style.

This is partnered by an almost Tarantino-esque storytelling technique, with a lot of jump cuts to interstitial screens that introduce characters and bosses as you meet them. Most memorable is the first boss you face, the menacing wastelander boss Nine Toes. When you first spy him, replete with Mad Max style





headware and strutting attitude, you get a rocking chord and a splashscreen intro to him, which also explains – inexplicably but amusingly – that he has three balls, too.

Waiter, there's an RPG in my FPS (again)!

If you've spent any time at all in *Fallout 3*, you'll have a handle on how *Borderlands* goes about blending first person action with detailed roleplaying mechanics, but it takes both genres in even more extreme directions.

On the action front, you've got location-based critical hits, an excellent random gun generator, on top of some awesomely custom-developed weapons ranging from pistols all the way up to missile launchers, and even multi-person vehicles. There are grenades, different ammunition loadouts and gear like armour and shields to further customise how you go about shooting and beating the crap out of anything that looks at you funny.

All of those tools will be available to four very different characters, which you'll choose based on whether you want to be essentially a sniper, a soldier, a brawling tank, or a stealthed rogue type.

Each character also has a very different reason for being on Pandora – revenge, dark secrets from their past, it's all there, so we'll be curious to see how this affects the game's replay value.

These character types also mesh perfectly with the game's four player co-op mode, which is arguably the game's biggest draw. You can drop into co-op campaign games locally or online, and you can do so dynamically, too. It's a bit like *Left4Dead* in that respect, but with the game's much longer campaign, and the deeper levelling and gear, you'll be getting a much more in-depth experience.

The game scales pretty well to match the number of players, too, throwing more enemies, and offering more ammo and gear in return. And the browsing of these games is pretty painless.

But it's *Borderland*'s levelling that really gets things interesting. As you progress, you'll unlock skill points that can be spent amongst three talent trees. The simple comparison is *Diablo*, really, and given the game's amount of gear, and the random drops you'll get of it as you play, it's an apt one. Mordecai, the game's sniper/hunter, can focus on ranged damage dealing, party damage buffering, or doing nasty things with his innate pet ability, for instance.

But is it all fun?

The bottom line is – yes. Awesomeness amounts, in fact. The skill advancement system never gets in the way of the game being a good shooter, and skilled gameplay is rewarded with lots of one-shot kills. At the same time, skilling up simply makes you – or your party – noticeably better at doing your job. The game never quite takes itself too seriously, either, so there's a lot of entertainment value from many of the NPCs and storylines. And the graphics... well, Randy really is right.

There are some niggles, though, but we really do feel churlish for bringing them up. Every drop has to be manually picked up – you can't just walk over stuff. In a big fight, with ammo running out, this can be a real challenge, and taking the time to line up that desperately needed clip of rifle ammo can cost you your life. Similarly, while it's great on paper, the vast amount of random weapons can become a little samey – once you get a good gun, most drops are simply trash. Then again, there's always the chance for some really weird combos, like the gun that simply makes people explode. Even the devs admit they're still getting surprised by the system – and so are we.  DH

PC, Xbox 360, PS3 (reviewed on 360/PC)

Developer Gearbox Software
Publisher 2K Games
Website www.borderlandsthegame.com/

Graphics
Simply stunning in execution.

96

Gameplay
Some repetition, but mostly fresh and fun.

89

Sound
Flavoursome and rich.

90

Overall
A shooter for all seasons, and a hit for Gearbox.

91%





Champions Online

The next great MMO, or just a douchebag in a cape?

When a company branches out into making its second MMO, it's usually expected they'll try a new genre. Not so Cryptic Studios, who – having impressed with City of Heroes/Villains – have decided to stick with superheroes in its latest effort at pleasing the roleplaying masses. Thus Champions Online, inspired by the classic pen and paper RPG.

It's an odd choice, to cover the same ground, but from the get-go Champions Online has a very different feel. Whereas Heroes/Villains could be said to be gritty, and tending toward 'realistic' graphics, CO is much more cartoony. If you know your comics, it's a Golden Age versus Chrome Age kind of thing.

Character creation is of course your first step, and it's detailed – you could release Champions' character creator as a separate product, and it would be an excellent tool for budding comics designers and superhero geeks. From hair style, facial structure through to chest width and depth to pose and stature, it's all there to be tweaked by a slider or a shaded a wide variety of colours.

This is great from two angles. Firstly – and you'll spot this in your first few minutes in-game – it makes it super-easy to create any existing character you want. We've already spotted three Iron Men/Women, two Hulks, a Neo, a Superman and even a Samus (from Metroid). Some of them even sport that name, thanks to Champions' method of mixing your toon's name with your account name to create a unique identifier.

The other side of that equation is that you're free to let your imagination run riot. Musclebound flying tentacle creature? Sure. A mecha bunny

rabbit? Odd, but yes. I daresay that if you'd ever played the original Champions, being able to create your old pen and paper character would be a special thrill.

The customisation even goes down to being able to choose how your chosen offensive powers are employed. If you have force beams, for instance, you can choose where the beam is emitted from. We've already spent an hour playing around just with character creation. (And no, you can't choose your bottom.)

Learning to fly

Of course, the true test of a game is in the playing, not the choosing-what-colour-your-tights-are. Champions Online drops you into

the action in an instanced version of the game's capital, Millennium City, which you get to share with every other newbie. You've got to stave off the dumbest alien invasion ever (then again, Golden Age badguys never were all that smart).

Here you get to learn the basics, from attacking and movement, to making the most of some of the physics-based aspects of Champions Online. As starter sections go, it's a little too long, but it covers all the bases quite nicely, while even letting you experience group open questing – like the public quests in Warhammer Online.

Sadly, this introduction also shows off some of the poorer elements of the game. So far, there's very little sense of chatter or community. Sure, there's a mess of costumed daredevils running around, but the game is so easy to solo (even at higher levels) that the necessity for teamwork is slight. What's more, without the overarching glue of a well-known and established canon to play off, the game lacks in the flavour department, especially with so many different takes on superheros wandering around. The comic-ey graphics and tongue-in-cheek characters (like Professor Silverback, a pen and paper original) don't really help, either.





With great power...

Still, there are some great systems in place in Champions, and there's a far greater sense of character customisation, even at the lower levels. Many other MMOs merely trick you into thinking you can customise your character, when all along you're simply picking every skill as it comes up, while choosing the builds that are proven most effective.

Champions, though, gives you a lot to choose from, and without relying too heavily on character classes. Every skill can be taken by any

actually refill the game's version of mana, which is a nice touch, meaning you'll always be able to regenerate enough power for this big showy skills.

And they are very showy. Our gunslinger (the handsome, not-at-all-like-Neo, Johhny Noir) can employ gun fu against close targets, unload a range of pistol-based attacks at range, and can even execute a powerful backflip-and-shoot move to disengage. And all of this just at level eight – things really open up at higher levels, offering some truly super-heroic abilities.

The game doesn't skimp on letting you

Without the overarching glue of a well-known canon to play off, the game lacks in the flavour department.

character, but are more or less expensive based upon your chosen archetype. Anyone can learn munitions-based powers, but my Gunslinger gets them earlier and cheaper, for instance.

Some powers are passive, and are always on, while others need to be activated. Some powers

do even cooler stuff, either, as you unlock movement powers very early on. You can fly, surf ice or rock or whatever, jump huge heights or simply do a bit of all of them. Again, it's all about choice, and whatever else the game doesn't quite deliver, it certainly gives you a lot of choice.



... comes great responsibility

An MMO's responsibility is to serve its audience with a stable, socially interactive gaming experience, and I'm not quite sure that Champions really delivers on that front. The game is heavily instanced, meaning that any sense of community is really hard to get going. There are multiple instances of every zone on the server; you can let the game choose for you, or choose yourself which instance you switch into if you want, but this still isn't ideal.

One of the things that appeals to me about MMOs is that sense of getting to know people. You'll see that paladin who always needs help killing mobs, or start to recognise the same names arguing over good DPS builds in chat – you don't get that here. It's just one more subtle thing that makes Champions feel less like a living breathing MMO world than a singleplayer game that you're sharing with a lot of random people.

It's early days in Champions Online's lifecycle, but we're finding it a chore to come back to it already.  **DH**

Pr

Developer Cryptic Studios
Publisher Namco Bandai
Website www.championsonline.com

Graphics

Gameplay

Sound

Cheesy, but not all that impactful.

81
70
74

Overall
Diverting enough, but lacking longterm appeal at this stage.



Batman: Arkham Asylum

Can the Dark Knight conquer gaming like he did the cinema?

Batman is one of those iconic superheroes that can be returned to time and time again. The Bat has survived campy television shows, Val Kilmer and George Clooney, and reboots both live action and animated. For each work of common drudgery, we've gotten quality tales like the Batman animated series, Chris Nolan's latest epic works, and now this, Batman: Arkham Asylum.

It's not only the greatest Batman game you'll ever play – it's quite possibly the best superhero game you'll ever see.

The premise is deceptively simple: the Joker has been captured by his archrival yet again, and is being returned to the high security insane asylum that is his second home. But the Joker has a surprise in store for Gotham, and when he escapes and takes over Arkham, it's up to Bats to track him down and bring him to justice.

Rough justice

First and foremost, Arkham Asylum is an action game. It takes the fluid combat of games like God of War, puts a cloak on it, and then ratchets the cinematic impact up about 100 per cent.

Fighting is essentially a matter of using the

single main attack button, and the left thumb stick, to pummel in any direction you want. Each successful blow chains together to deliver more damage and some very brutal slow motion take downs. You can also sense when an enemy is about to unleash an attack of their own, and counter it with similarly gruesome results.

Like the whole game, it's pretty simple, but it delivers one of the most finely tuned fighting games we've ever played. With each chained blow your reach improves as well, so a fight between your caped self and fourteen murderous inmates can quickly escalate into a balletic back and forth that has bodies tumbling about and Batman diving between assailants like some kind of feral beast. There's simply no other game that will leave you feeling as tough as Arkham Asylum will.

There's a stealth aspect to the game, too, especially when you're dealing with opponents armed with shotguns and rifles. Here you can employ silent – and remarkably visceral – takedowns, rather than getting into all-up brawls. There's a lot of other possibilities for dealing damage, but these rely more on Batman's unique tools and talents.





Batman is a scientist

Batarangs, enhanced vision, grapple guns... Batman is the archetypal gadgeteer when it comes to superheroes, and all the toys you'd expect – and a few more – are here. The batarang is an awesome tool for taking out some of the tinier of the Joker's own toys, and can be used to stun opponents at range. Batman can also toggle an alternate vision mode – Detective mode – where clues and useful items in the environment are highlighted in a hi-tech HUD-style display. This can also sense nearby enemies, their armament, and even small details like their heart-rate, so you can measure how agitated they are. It's a bit of superscience, but it offers a clever in-game excuse for superheroic heightened senses. And looks pretty neat, too.

The grapple gun, though, is possibly the neatest tool on Batman's awesome belt 'o' fun. There are numerous points about Arkham – gargoyles, ledges, and so on – that you can grapple up to. This often breaks line of sight with enemies, so it's a wonderful and flavoursome get out of jail free card, but it also lets you use some of Batman's more iconic skills. You can glide from these heights, cape out-stretched, or even

glide-kick opponents and then take them down while they're recovering. You can even learn to hang upside down to really surprise passing badguys.

Games within games

If the cool toys and action where all that Arkham Asylum had to offer, it would still be a solid game, but what takes it ahead of the pack is the attention to detail and surprising depth of the game. There are achievements aplenty for the ADD-crowd, and added challenges scattered around Arkham for you to unlock. For instance, while the Joker has been hatching his dastardly plot, the Riddler has been setting up his own puzzles to perplex Gotham's favourite crime fighter. You really feel like you're getting a tour of Batman's world, and Arkham is absolutely the finest stage for it – and an excellent commentary on Batman's own considerable psychosis.

Wrapping all of these elements together, however, are the top-notch graphics and outstanding voicework that gives the game its flavour. Top of the talent on show would have to be Mark Hamill, who, along with Kevin Conroy and Arleen Sorkin, reprise their roles from the animated series. These actors lend such gravitas

and venom that you cannot help but take these heroes and villains seriously – good acting is something that Chris Nolan certainly understood was necessary for his recent reboot, and it delivers much the same impact here.

Graphically, there are few games more fully realised than this. From the forbidding interiors to the riveted details of Batman's suit, not one beat has been missed by the design team. The fluid action of the game would be nothing without fluid character animation, too, but it doesn't let down. There's some frame issues on the 360, but they're rare enough to not cause a problem.

Now, normally we'd be all for reviewing a game like this on the PC, where you can really up the graphical splendour and take advantage of things like solid anti aliasing and anisotropic filtering. But the controls really do work best on the Xbox. The experience is so cinematic that it's one you'll want to watch on the largest screen in the house; good speakers – like our Krix test setup – don't hurt either. This is game as entertainment, and you'll almost certainly draw a crowd as you play.

And it deserves one; Batman: Arkham Asylum is very nearly game of the year. EF DH

PC, Xbox 360, PS3 (reviewed on 360)

Developer Rocksteady Studios

Publisher Namco Bandai

Website www.batmanarkhamasylum.com

Graphics

Never less than atmospheric, despite some frame rate issues.

89

Gameplay

As rich and deep as Batman's history.

97

Sound

The best sounding game this year.

Tops voice work.

99

Overall

Move over Kratos – Batman's top of the action crown now.

98%





Heroes over Europe

Tally-ho! Pip-pip! What?!

Ubisoft and its stable of developers is having a bit of a love affair with World War II. We can't blame them, really – for a certain kind of war-nerd, it's the ultimate war. There's clear bad guys, some great technologies, and at the same time it was still a war where the combatants – for the most part – had to look one another in the eye. We're as partial to a bit of WWII action as the next man, so we had high hopes that *Heroes Over Europe* would stack up to its stable-mates, *R.U.S.E* (not yet released, but we have faith it'll be awesome) and *Order of War* (which we've previewed, and quite like).

HoE (read it, don't say it) is very much a modern arcade flyer. It has to be arcade, if it's going to be popular on the Xbox – there's just not enough controls to spare to offer the same level of detail that a PC-based flight sim can deliver (anyone here remember *Falcon 4.0*?). But that doesn't mean it has to be a dumbed down experience...

In theory.

Jam and biscuits!

Each level of each campaign – and that should get warning bells going right there – opens with a tacky yet charming newsreel-style bit of exposition explaining the state of war. It's all "give that man a coconut, grandma" style faux-British reporting, but it does its job. Similarly, there are some rather moody animations that introduce what your character is doing at that point in time.

'You', by the way, are a young American pilot who lied about being Canadian so he could get into the RAF, at least in the first campaign. We're guessing this is one of those things where

someone's decided that British accents don't play well in the states, so let's make an American flyer. Sure, many Americans did join up early on to fight the Hun, but it's it comes off as an annoying contrivance in the game.

But you're not playing *HoE* (remember what we said) for the story.

You're playing it get into the air and smash the Luftwaffe, and the first mission is the obligatory training level, full of aircraft that are tricky to dodge and an annoying flight leader (who is of course a bitter veteran of WWI).

The mission begins with you on the ground, which is always a nice sign in flight sims, but the juicy take-off we were expecting could be handled by a two-year old. Your superior is

obviously bent on terrifying the local French, and gets you to buzz a church, a village and an old castle – 'cause nothing shows your flying chops like scaring cows, apparently.

Then it's on to a ludicrously un-escorted flight of German bombers, and once they're destroyed it's time to take out their heinously late fighter escort. "Gee," thought I, all we need is a lonely vehicle convoy" and... bam! There one was! With that out of the way, it's time for a proper furball – with baddies that actually shoot back – and your introduction to the game and its mechanics is complete.

But the rage will simmer on.

You see, this is WWII by way not only of the arcade, but also arcade shoot-em-ups. For





Scribblenauts

Cartoony graphics belie deep gameplay.

Our first reaction to seeing a Nintendo DS game in the hallowed pages of Atomic is probably one of intense shock (perhaps you've already started to write death threats), but before you go too far this game is actually deserving of some attention. It might be available only for the touch-sensitive DS, be cartoony in style and appear simple on the surface – but this is one game that is as deep and complicated as your imagination can go.

The game kicks off with a simple tutorial and puts you in the shoes of Maxwell, a lovable scamp complete with rooster-style hat. The top screen shows basic information such as level title, the amount of Ollars (money) you have, the Par you should be able to complete the level in and a simple gauge to show how many objects you've actually used (more on this later). On the bottom screen is Maxwell; a simple tap makes him run to the area on the screen, or if an object is hit he'll interact with it (sometimes using a context-sensitive menu).

Creative freedom

Each level starts with a simple goal, such as 'Get the Starite' placed at the top of a tree. Where this game sets itself apart from every other game out there is that it doesn't place any constraints on how you can achieve this particular goal; by clicking on the notepad at the top-right corner of the touchscreen a keyboard or scribbling pad will appear. This is the most powerful tool in the entire game and practically any word – that isn't trademarked, raunchy or alcoholic – can be written, bringing the object into play.

Using the example of the Starite on top of a tree, the easiest way to reach it is simply an axe that lets Maxwell chop the tree down. Don't want to get your hands dirty? Spawn in a Lumberjack, give him the axe, and let him chop it down for you! Burn the tree down with a flamethrower, blast the Starite out of the tree with a bazooka, zip up there in a rofcopter or climb a ladder to get the job done. There are as many possibilities to get it as there are combinations of items in your head, and they can range from the simplest choice to the over-the-top complicated solutions.

For example you can have Maxwell wearing an Invisibility Cloak, in a baseball cap, wearing stilts, himself riding a gorilla in a top hat, the gorilla riding a unicycle – and the entire man/beast/machine combo launching themselves off a ramp to nab the Starite.

Unintentionally funny situations can practically evolve out of this completely random nature of whatever pops into your mind, such as when a

Priest (who is oddly immortal) chases the Grim Reaper to devour the delicious roast chicken he's holding because someone took his Scythe away. Ninjas battle to the death with pirates while Cthulu wages war against an ancient Kraken, itself preoccupied by the terrified clown holding a puppy. Teleporters whisk Maxwell to an alternate dimension where a Van Helsing clone must defeat mummies and a werewolf, Time Machines zap him back to the middle ages and chloroform is passed liberally around to security guards in a museum.





... 5th Cell has done an excellent job of making each of the tens of thousands of objects feel like their real world counterparts...

Guiding star

Without direction all this freedom would eventually become boring, and while there are plenty of 'get the star' objectives there are just as many other objectives to complete. Ranging from quenching a thirsty man in a desert, stopping a runaway truck before it falls off a cliff or re-uniting a family of penguins, there is enough variety here to keep things interesting without becoming too repetitive. On top of that, achievements are awarded per level for the use of unique items you've not used before, and special challenge modes unlocked where you must defeat the level three times using completely different objects each time.

There are a whopping 220 levels included with the game, and it also packs in a very basic level editor to give you some (admittedly limited) scope for creating and sharing your own

levels via wireless. Unfortunately while it is a large number, not all of these levels are actually fun – some of them are merely frustrating or too straightforward. These are in the minority, but distract from the game quite a bit, and frequent restarts are never enjoyable.

In terms of actually being able to put together a game like this however, 5th Cell has done an excellent job of making each of the tens of thousands of objects feel like their real-world counterparts, and considering the phenomenally huge amount of interactions that would have had to be worked out this is a testament to the team's skill. The graphics are understandably crude, but exude a level of cute charm that make them quite endearing. Sound effects are simple but give more than enough of an idea about the object to make it believable, and the gameplay is intuitive enough to let your grandma have a go without hassle.

Too much of a good thing?

With all the things that this game does brilliantly, there are invariably a few drawbacks to it. If you're not particularly imaginative, or are tired, you might get easily frustrated at some challenges that can require more finesse than eye surgery. If you love overarching storylines and character development you'll find none of it here; there's no real ending nor beginning – just one very good middle.

When all is said and done, Scribblenauts is a standout game for a system that has traditionally been filled with cookie-cutter platformers or games aimed at kiddies, and while Scribblenauts isn't always outstanding, it offers just enough to give a serious reason to buy a DS. We'll definitely be going back for more.  JR

Nintendo DS

Developer 5th Cell
Publisher Warner Bros. Interactive Entertainment
Website www.wbie.com

Graphics
 Not incredible, but fits the game very well.

Gameplay
 Mind-boggling amount of choice, as long as you want it to be.

Sound
 Does the job.

85
96
70

Overall
 Good enough to earn a place in the hall of gaming.

90%



BOOK REVIEW

Retribution Falls

It can be a slog, but this new lighter than air fantasy from **Chris Wooding** delivers in the end.

I recently picked up this new fantasy work based on the recommendations of my favourite local bookstore. "A kind of fantasy Firefly," they called it, so I was instantly curious. And within a few pages, I could see where the shop's staff was coming from – but I wasn't sure they were right.

Retribution Falls is pretty pulpy at its heart. It's the tale of a band of ne'er-do-well pirates and freebooters, plying the trade lanes of a nameless fantastic world where the lighter-than-air Aerium gas has provided cheap and easy air travel in an otherwise Victorian-age milieu. After a couple of nasty wars, Darian Frey, captain of the freighter Ketty Jay, just wants to be free to make an easy buck and fly below the notice of the Coalition Navy.

The Firefly comparison is pretty easy, as is the similarities to Mal Reynolds or Han Solo. But the difference is that Frey – or any of his crew, for that matter – aren't really likable.

Each of the crew, from the Captain down to the ship's drunken surgeon is running from some dark secret – only the taciturn engineer seems to be so straightforward as to not be hiding anything, but then he's a real Chewbacca analogue anyway: the enigmatic barbarian/

outlander who is nonetheless the Captain's one point of reference.

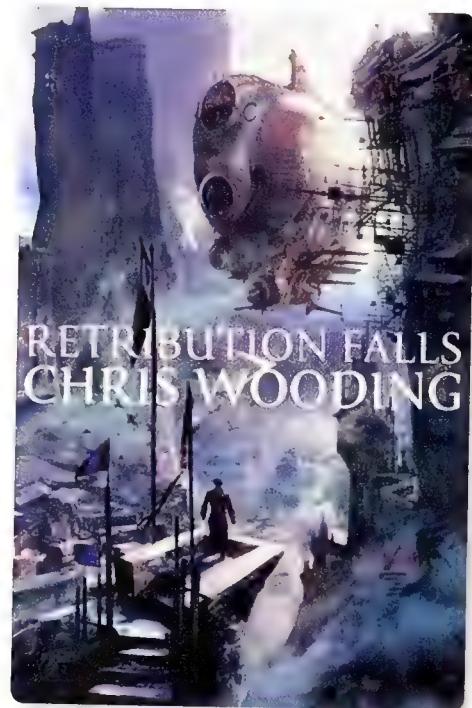
It's Firefly alright, but with characters that, to be honest, I'd be happy to see caught and hanged, which is exactly what's likely to happen once Frey takes a job that turns out to be a setup, leading them to be wanted by everyone from bounty hunters to elite knightly orders.

There's enough thrills to keep the pace rolling along, and Wooding plots out the story wonderfully, but more than once I felt unsatisfied to be spending time with the Ketty Jay's crew. There was an unread copy of Iain Banks' latest in my shelf at the time, and man was I tempted to put down Falls and pick it up.

In the end, though, Falls delivers.

The pressure of the pursuit and the need to prove themselves innocent pushes the crew to better themselves. It's a little too pat that everyone gets their revelatory moment, but by then you've come to like these guys – much as Frey does, when he realises he's the captain of a crew, as well as a ship.

The book's full name – Retribution Falls: Tales of the Ketty Jay – hints at more books to come, and we'll be eager to see what this bunch of reprobates made good get up to.  DH



Overall
Worth sticking with; a solid pulp fantasy.

79%

DISC OF THE MONTH

GENERATION KILL



Year's end – we get inundated with top tech, great games and an excess of cool stuff on DVD and Blu-ray. While we've thoroughly enjoyed revisiting season one of JJ Abram's latest mythology-fest, Fringe, on Blu-Ray (and it looks stunning), and been thrilled by Madman's re-release of Akira on the same format (oh, fuck me, the sound is AWESOME), what's really grabbed our interest this month is the local release of **Generation Kill** on DVD.

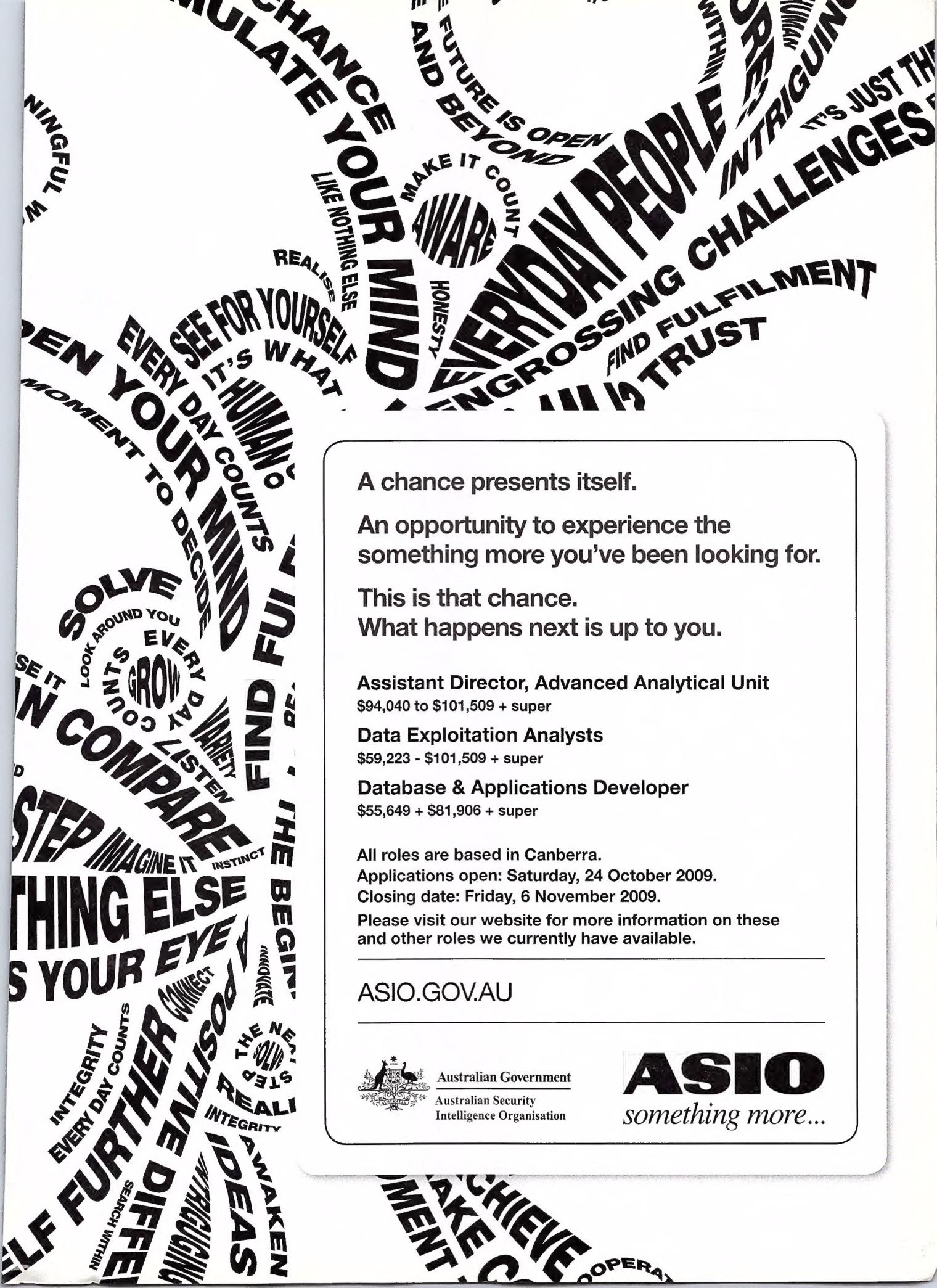
Set during the opening stages of Operation Desert Storm II, Kill follows the members of a US Marine Recon battalion as they push into Iraq. It's classic military story-telling, made punchy by writing from The Wire veterans David Simon and Ed Burns. Even some Wire actors show up, but it's an all-round ensemble performance that shows the chaos, cost and – at times – the thrill of modern warfare.

It's also suitably epic in scope, with some great effects depicting vast columns of vehicles crossing the desert, and attack helicopters swooping in for the kill.

Worth picking up; an easy win for our Disc of the Month.

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Flying high

Ben Mansill pays homage to an application that has inspired a generation of virtual pilots, pushed PC hardware relentlessly onwards and defined the state of the software engineering art.

Since the dawn of PC gaming, flight sims have pushed the envelope, defining many fundamentals we now accept as core to the entire spectrum of gaming. Above any other genre, they have always demanded the fastest hardware. Reproducing the complex dynamics of flight and replicating sophisticated avionics is a huge design challenge even for NASA and aerospace companies. That a convincing sim can exist on PC hardware today is a wonder, but words can't describe what a miracle it was on a 8MHz 286 in 1982. Flight sims rock because we love the taste of knowing something is the very best it can be.

Graphics were crude and focussed where it mattered. We needed crisp displays to show detailed instruments. Rendering the first 3D worlds with horizon-spanning draw distances was limited to a few perspective lines. Indeed, the jump to SVGA in the late 90s was a momentous step for flight sims, not so much because the terrain looked better, but because the avionics were more detailed and readable. Flight simmers look down more than up.

Hand in hand with the early technology wins, flight sims helped define the culture and meaning of what it is to be a PC gamer. A good sim's complexity demanded weeks to master, dozens or even hundreds of keys to remember, 300 page manuals, and with all that, a sense held by the virtual pilot that they really were more sophisticated, more serious, more skilled than a mushroom hopping console gamer. We played sims because, forgive me for stating the obvious -- they were simulations of things we could never do in our real lives. One felt that one really could fly, say, a real F-16, as long as it had a 101 keyboard in the cockpit... This was serious stuff, for serious gamers.

Indisputable credit is owed to Microsoft's Flight Simulator. This single piece of software can rightly be credited with playing a key part in the success, and more importantly, perception of the PC and what it is capable of. It is as much engineering art as it is a thing to be enjoyed.

The very first iteration of Flight Sim was unveiled in 1975(), as a thesis project for the Apple II, followed up with the commercial release of Flight Simulator 1.0 in 1980, again for the Apple II. Microsoft, then all about software, cannily saw the dazzling value and commissioned Flight Simulator 1 for the PC, which was released in 1982. It was a move that attracted a lot of attention for the fledgling PC, ramming its technological and leisure potential home to punters who previously only thought of the PC as a utilitarian spreadsheet box. Suddenly the

PC was sexy and sophisticated in a way the average person could relate to.

FS1, of course, looked nothing like the sims we enjoy today, but it, and the subsequent still-basic versions that followed through to 5.0 in 1993 which was the first to look good, all turned that weakness to an advantage. For, while the world outside the window was a stark grid of textureless vectors, the cockpit was an impressive array of accurate functional avionics. Just like a real plane, in 16-colour EGA. It was flying by instruments alone, a mental challenge, not visual, and this cemented what flight simming is all about, which holds true today as flight model realism plus avionics and cockpit reproduction are still more important than pretty graphics.

Not long after FS1, addon map-packs began to appear, soon representing all of North America in its vector splendour, allowing pilots to plan and fly long distance trips, refuelling at real-world airports. This thinking was another shift for how PC gaming would evolve, which has reached overwhelming maturity today, with the whole world now virtualized in high res.

Microsoft bought the Flight Simulator license in 1988 kick-starting Microsoft's commendable commitment to the series, and setting the standard for staying true to a design ethos which would last 20 years.

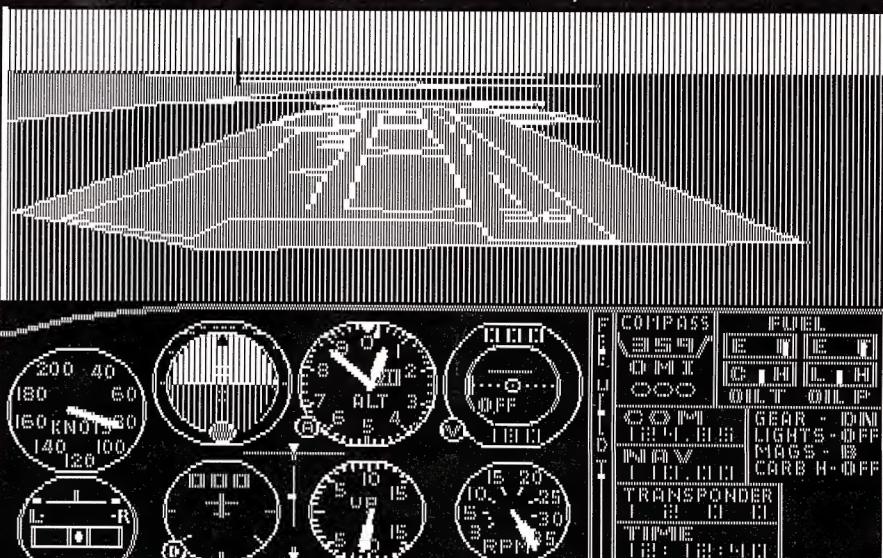
Since then, every new version has lifted the bar higher -- not just for the series, but PC gaming and its maximum exploitation of hardware and software. As each new version had a shelf-life of 2-3 years, a huge degree of performance headroom was built-in, anticipating

Moore's Law and playing to it. No PC can ever run a version of Flight Sim at max detail upon release, but you can just do it after a couple of years of upgrades -- by which time a new version will appear. This cycle helped define PC gaming's relationship with the hardware. It acknowledged that a simmer would go through multiple system upgrades through the life of a version, lifting the game experience each time. It allowed the development team to make each new version a spectacular leap forwards. Flight Sim has always been one of the most sophisticated things you could ever run on your PC.

Ironically and tragically, this exponential evolution was to become a fatal bind that crushed the series, squeezing it to a sad death when Microsoft shut down its internal ACES development team, laying off the staff in the dark depths of the GFC in January 2009. Player expectations and development complexity had exploded costs and the team size. To exponentially improve upon the outstanding FSX, the last release in 2006, was untenable without a huge team and years of development, all serving a shrinking relative niche.

FSX will live on for many years yet, it's still unplayable on max settings with even the meatiest rig, and has the support of vast 3rd party commercial and community activity.

Flight Simulator flew high, taking the PC with it, and countless grateful gamers who were able to live the fantasy of flight. We salute it. It is one of the greatest triumphs of technology, gaming culture and enthusiast passion. ☺





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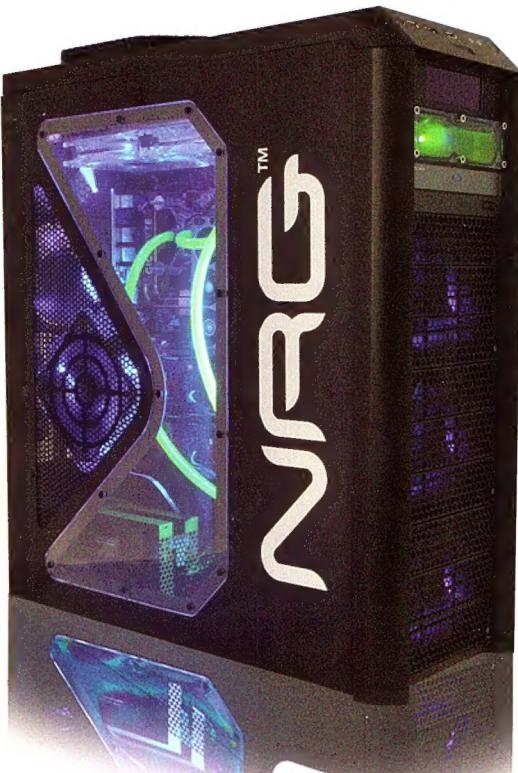
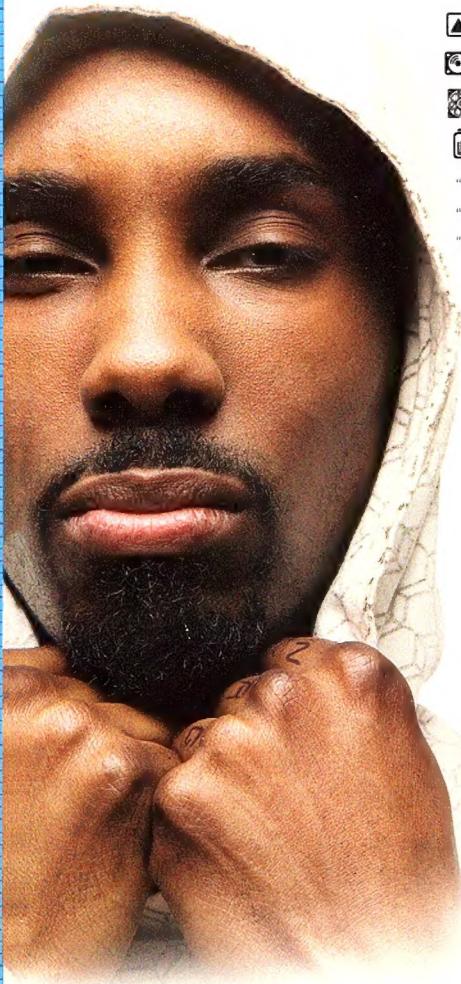
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